PRESENCE OF A TRACHEOTOMY TUBE AND ASPIRATION STATUS IN EARLY, POSTSURGICAL HEAD AND NECK CANCER PATIENTS

Steven B. Leder, PhD, John K. Joe, MD, Douglas A. Ross, MD, Daniel H. Coelho, MD, Joseph Mendes, MS, PA-C

Department of Surgery, Section of Otolaryngology, Yale University School of Medicine, P.O. Box 208041, New Haven, CT 06520-8041. E-mail: Steven.Leder@Yale.edu

Accepted 22 March 2005
Published online 5 August 2005 in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/hed.20239

Abstract: Background. We sought to investigate the effects, if any, that the presence of a tracheotomy tube has on aspiration status in early, postsurgical head and neck cancer patients.

Methods. Twenty-two consecutive adult, postoperative head and neck cancer patients were prospectively evaluated with fiberoptic endoscopic evaluation of swallowing (FEES) under three conditions: (1) tracheotomy tube present, (2) tracheotomy tube removed and tracheostoma covered with gauze sponge; and (3) tracheotomy tube removed and tracheostoma left open and uncovered. For each condition, the endoscope was first inserted transnasally to determine aspiration status during FEES and then inserted through the tracheostoma to corroborate aspiration status by examining the distal trachea inferiorly to the carina. Three experienced examiners determined aspiration status under each condition and endoscope placement.

Results. There was 100% agreement on aspiration status between FEES results and endoscopic examination through the tracheostoma. Specifically, 13 of 22 patients (59%) swallowed successfully and nine of 22 (41%) aspirated. There was also 100% agreement on aspiration status for tracheotomy tube present, decannulation and tracheostoma covered by gauze sponge, and decannulation and tracheostoma left open and uncovered.

Conclusions. Neither presence of a tracheotomy tube nor decannulation affected aspiration status in early, postsurgical head and neck cancer patients. The clinical impressions that a tracheotomy or tracheotomy tube increases aspiration risk or that decannulation results in improved swallowing function are not supported. Rather, need for a tracheotomy indicates comorbidities (eg, respiratory failure, trauma, stroke, advanced age, reduced functional reserve, and medications used to treat the critically ill) that by themselves predispose patients for dysphagia and aspiration. © 2005 Wiley Periodicals, Inc. Head Neck 27: 757–761, 2005

Keywords: tracheotomy; aspiration; deglutition; deglutition disorder; head and neck cancer

Tracheotomy, a routine surgical procedure performed approximately 1,468,000 times/year,¹ does not effect swallowing in most patients. Rather, dysphagia and aspiration result from the critical illness that necessitated the tracheotomy in the first place.²—⁵ However, despite recent research that found no causal relationship between tracheotomy and aspiration status (ie, no differences in
incidences of aspiration pretracheotomy versus posttracheotomy), the clinical impression persists that tracheotomy and placement of a tracheotomy tube are associated with increased incidence of aspiration, whereas decannulation will result in improved swallowing function.

Swallowing improvement, however, occurred when the tracheotomy tube remained, swallowing dysfunction continued after decannulation, and swallowing behavior remained unchanged with or without a tracheotomy tube. Therefore, the assumption that the tracheotomy tube, in and of itself, disturbs swallowing and increases incidence of aspiration cannot be supported.

Recent research found that tracheotomy tube removal did not improve swallowing ability in rehabilitation patients with long-term tracheotomy use (ie, mean 81 days). Also, tracheotomy did not affect aspiration status in previously healthy, young adults who had traumatic war injuries. The purpose of this study was to investigate the effects, if any, that the presence of a tracheotomy tube had on aspiration status in early, postsurgical, head and neck cancer patients.

**PATIENTS AND METHODS**

**Subjects.** Twenty-two consecutive, adult, postoperative patients with head and neck cancer were prospectively enrolled between December 2, 2003, and August 16, 2004. Criteria for inclusion were oral, pharyngeal, or laryngeal cancer; recent surgical resection of the tumor; referral for a dysphagia evaluation; and suitability for decannulation (Table 1).

**Procedures.** All patients were evaluated with fiberoptic endoscopic evaluation of swallowing (FEES) under three nonrandomized conditions: (1) tracheotomy tube present, (2) tracheotomy tube removed and tracheostoma covered gently with gauze sponge, and (3) tracheotomy tube removed and tracheostoma left open and uncovered. For each condition, the endoscope was first inserted transnasally to determine aspiration status during FEES and then inserted through the tracheostoma to corroborate aspiration status by examining the distal trachea inferiorly to the carina. Aspiration was defined as entry of material into the airway below the level of the true vocal folds. Three experienced examiners agreed on aspiration status under each condition and endoscope placement.

The standard FEES protocol was followed with slight modifications. Each naris was examined and the scope passed through the most patent naris without administration of a topical anesthetic or vasoconstrictor to the nasal mucosa, thereby eliminating any potential adverse anesthetic reaction and assuring the endoscopist a safe physiologic examination. The base of tongue, pharynx, and larynx were viewed and aspiration determined for each condition by first using up to three 5-mL boluses of puree (pudding) followed by three 5-mL boluses of liquid (milk). To limit the overall volume of aspirated material, ingestion of liquid was deferred if puree was aspirated. No attempt was made to quantify amount of aspiration. When aspiration occurred, either a reflexive or volitional cough cleared both the proximal and distal trachea of aspirate, which was confirmed visually by tracheostoma placement of the endoscope before progressing to the next condition.

**RESULTS**

Table 1 shows patient demographics and aspiration status for all subjects under the three experimental conditions: (1) tracheotomy tube present, (2) tracheotomy tube removed and tracheostoma covered gently with gauze sponge, and (3) tracheotomy tube removed and tracheostoma left open and uncovered. There was 100% agreement on aspiration status between FEES results and endoscopic examination through the tracheostoma. Specifically, 13 (59%) of 22 patients swallowed successfully, and nine (41%) of 22 patients aspirated. A two-tailed Student’s t test indicated that duration posttracheotomy was not significantly different (p > .05) for aspirators (n = 13, mean 11.7 days) versus nonaspirators (n = 9, mean 15.1 days). There was also 100% agreement on aspiration status among the three conditions (ie, tracheotomy tube present, tracheotomy tube removed and tracheostoma covered by gauze sponge, and tracheotomy tube removed and tracheostoma left open and uncovered). Patients either swallowed successfully or exhibited evidence of aspiration under all three conditions.

Participants who had a metal tracheotomy tube (n = 18) were additionally investigated with regard to tracheotomy tube capping and aspiration status (Table 1). No trend was observed for capping status and incidence of aspiration (ie, capped and no aspiration [n = 7], capped and
aspiration \( n = 4 \), uncapped and no aspiration \( n = 3 \), and uncapped and aspiration \( n = 4 \)).

**DISCUSSION**

No immediate effect on aspiration status was exhibited in early, postsurgical, head and neck cancer patients under the three experimental conditions (ie, tracheotomy tube present, tracheotomy tube removed and tracheostoma covered by gauze sponge, and tracheotomy tube removed and tracheostoma open and uncovered). This is in agreement with findings reported with rehabilitation patients requiring long-term tracheotomy\(^{15} \) and previously healthy, young adults who required a tracheotomy after traumatic war injuries.\(^{16} \) Results from three different patient populations, therefore, do not support the clinical impressions that a tracheotomy or tracheotomy tube increases incidence of aspiration or that decannulation results in improved swallowing.

The predisposing factor for aspiration in this study was surgery, and, not surprisingly, the

---

**Table 1.** Participant demographics and aspiration status under three conditions: (1) tracheotomy tube present, (2) tracheotomy tube removed and gauze sponge over tracheostoma, and (3) tracheotomy tube removed and tracheostoma open and uncovered.

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Sex</th>
<th>Age, y</th>
<th>Diagnosis</th>
<th>Tracheotomy tube/ duration, d</th>
<th>Aspiration status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>51</td>
<td>T4N2aM0 larynx</td>
<td>#6 uncapped cuffless plastic/32</td>
<td>– – –</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>43</td>
<td>Recurrent supraglottic</td>
<td>#6 uncapped metal/94</td>
<td>– – –</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>70</td>
<td>Recurrent mandible</td>
<td>#6 capped metal/7</td>
<td>– – –</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>61</td>
<td>T3N3M0 base of tongue</td>
<td>#6 uncapped metal/27</td>
<td>+ + +</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>62</td>
<td>T3N1M0 right tonsil</td>
<td>#6 capped metal/18</td>
<td>+ + +</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>50</td>
<td>Right lower lip commissure*</td>
<td>#6 capped metal/14</td>
<td>– – –</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>75</td>
<td>Recurrent left junctional tongue</td>
<td>#6 capped metal/7</td>
<td>– – –</td>
</tr>
<tr>
<td>8</td>
<td>F</td>
<td>71</td>
<td>Right alveolar ridge*</td>
<td>#6 capped metal/11</td>
<td>– – –</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>59</td>
<td>Recurrent oral cavity</td>
<td>#6 capped metal/7</td>
<td>– – –</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>65</td>
<td>T4N2bM0 floor of mouth</td>
<td>#8 uncapped cuffed plastic/7</td>
<td>+ + +</td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>57</td>
<td>T4aN2bM0 right oropharynx</td>
<td>#6 uncapped cuffless plastic/7</td>
<td>– – –</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>68</td>
<td>T4N1M0 right retromolar trigone</td>
<td>#6 uncapped metal/7</td>
<td>+ + +</td>
</tr>
<tr>
<td>13</td>
<td>F</td>
<td>64</td>
<td>Recurrent left buccal</td>
<td>#4 uncapped metal/13</td>
<td>– – –</td>
</tr>
<tr>
<td>14</td>
<td>M</td>
<td>56</td>
<td>T2N0M0 supraglottic</td>
<td>#4 uncapped metal/12</td>
<td>+ + +</td>
</tr>
<tr>
<td>15</td>
<td>M</td>
<td>72</td>
<td>T3N0M0 right oral tongue</td>
<td>#6 uncapped metal/10</td>
<td>– – –</td>
</tr>
<tr>
<td>16</td>
<td>M</td>
<td>51</td>
<td>Phosphaturic tumor of mandible</td>
<td>#6 uncapped metal/10</td>
<td>+ + +</td>
</tr>
<tr>
<td>17</td>
<td>M</td>
<td>58</td>
<td>T2N2bM0 right base of tongue</td>
<td>#6 capped cuffless plastic/16</td>
<td>– – –</td>
</tr>
<tr>
<td>18</td>
<td>M</td>
<td>47</td>
<td>T3N0M0 left oral tongue</td>
<td>#6 capped metal/7</td>
<td>– – –</td>
</tr>
<tr>
<td>19</td>
<td>F</td>
<td>52</td>
<td>T3N2cM0 soft palate</td>
<td>#6 capped metal/10</td>
<td>+ + +</td>
</tr>
<tr>
<td>20</td>
<td>M</td>
<td>54</td>
<td>T4aN2bM0 left base of tongue</td>
<td>#6 capped metal/7</td>
<td>+ + +</td>
</tr>
<tr>
<td>21</td>
<td>M</td>
<td>52</td>
<td>T3N0M0 left base of tongue</td>
<td>#6 capped metal/11</td>
<td>– – –</td>
</tr>
<tr>
<td>22</td>
<td>M</td>
<td>60</td>
<td>T4N2bM0 right tongue</td>
<td>#6 capped metal/7</td>
<td>+ + +</td>
</tr>
</tbody>
</table>

17 male patients Mean age = 58 y
Range, 43–72 y

5 female patients Mean age = 61 y
Range, 52–71 y

Abbreviation: FEES, fiberoptic endoscopic evaluation of swallowing.

\(^{15} \)TNM staging not available.

\(^{16} \)Tracheotomy tube cuff was deflated before inclusion in study.

---

aspiration \( n = 4 \), uncapped and no aspiration \( n = 3 \), and uncapped and aspiration \( n = 4 \)).

**DISCUSSION**

No immediate effect on aspiration status was exhibited in early, postsurgical, head and neck cancer patients under the three experimental conditions (ie, tracheotomy tube present, tracheotomy tube removed and tracheostoma covered by gauze sponge, and tracheotomy tube removed and tracheostoma left open and uncovered). This is in agreement with findings reported with rehabilitation patients requiring long-term tracheotomy\(^{15} \) and previously healthy, young adults who required a tracheotomy after traumatic war injuries.\(^{16} \) Results from three different patient populations, therefore, do not support the clinical impressions that a tracheotomy or tracheotomy tube increases incidence of aspiration or that decannulation results in improved swallowing.

The predisposing factor for aspiration in this study was surgery, and, not surprisingly, the
location and extent of surgery resulted in increased incidence of aspiration (Table 1). This supports the hypothesis that dysphagia and aspiration are due to the critical illness that necessitated the need for a tracheotomy tube in the first place.\textsuperscript{2–5} Contributing factors include, but are not limited to, respiratory failure,\textsuperscript{4,5,21} trauma,\textsuperscript{22} stroke,\textsuperscript{23,24} altered mental status,\textsuperscript{25} advanced age and decreased functional reserve,\textsuperscript{11,26} and use of medications used to treat the critically ill.\textsuperscript{13}

Duration posttracheotomy in this study was not significantly different between aspirators (11.7 days) and nonaspirators (15.1 days). Tracheotomy tube removal after longer-term use in rehabilitation patients (ie, 81.3 days) also had no immediate effect on aspiration status.\textsuperscript{15} It would be of interest to determine whether removal of a tracheotomy tube after even longer use (ie, years) results in similar findings regarding aspiration status.

Controversy continues regarding whether tracheotomy tube occlusion affects incidence of aspiration. Some reports indicated that occluding the tracheotomy tube with a plug\textsuperscript{27,28} or one-way speaking valve\textsuperscript{29–31} could decrease or, in selected cases, eliminate aspiration. It may be that subject selection bias or specific bolus consistencies (eg, liquid versus puree) affected aspiration status. When both subjects and bolus consistencies were controlled for, equivocal results were reported regarding capping trials and aspiration status (ie, valve use did not always improve swallow physiology and in some instances exacerbated oral and pharyngeal residue).\textsuperscript{32}

In this study, occlusion status (ie, capped or uncapped) for both metal and plastic tubes did not influence incidence of aspiration. This is in agreement with previous research from medical patients\textsuperscript{33}; early, postsurgical, head and neck cancer patients\textsuperscript{34}; patients using a one-way tracheotomy speaking valve\textsuperscript{35}; and patients undergoing rehabilitation.\textsuperscript{15} Additional investigation of the relationship, if any, between tracheotomy tube occlusion status and incidence of aspiration is warranted.

Most, but not all, patients in this study who exhibited aspiration were eventually able to eat at least some food consistencies orally. The combination of individualized swallow rehabilitation, compensation by the highly adaptable oropharyngeal swallow mechanism, and surgical wound healing with edema reduction allowed for resolution of dysphagia and resumption of oral alimentation.

CONCLUSION

Neither the presence of a tracheotomy tube nor decannulation affected aspiration status in early, postsurgical, head and neck cancer patients. The clinical impressions that a tracheotomy or tracheotomy tube increase aspiration risk or that decannulation results in improved swallowing function are not supported. Because tracheotomy and placement of a tracheotomy tube are not causative for aspiration\textsuperscript{3} and removal of a tracheotomy tube does not improve swallowing ability,\textsuperscript{14,15} dysphagia leading to aspiration is likely due to pretracheotomy comorbidities that by themselves predispose patients for dysphagia and aspiration\textsuperscript{2–5} (eg, respiratory failure,\textsuperscript{4,5,21} trauma,\textsuperscript{22} stroke,\textsuperscript{23,24} altered mental status,\textsuperscript{25} advanced age and reduced functional reserve,\textsuperscript{11,26} and medications used to treat the critically ill).\textsuperscript{13} That is, the patient is either aspirating before tracheotomy\textsuperscript{3} or at risk for aspiration because of the critical illness that necessitated the tracheotomy in the first place.\textsuperscript{2}

REFERENCES


14. DeVita MA, Spierer-Rundback L. Swallowing disorders in