Tracheal Stoma Closure and Outcomes in Tracheotomy Patients

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Abstract

Objective: We investigated the outcomes of patients who underwent tracheotomy and how possible it was for closure of the tracheal stoma to occur. On the basis of these results, we highlighted points to note during surgery.

Methods: The subjects were 204 patients who underwent tracheotomy in our department between April 2010 and March 2015. Patients were classified into 6 categories according to the primary disease: head and neck disease, cranial nerve disease, cardiovascular disease, digestive disease, respiratory disease, and other disease.

Results: Outcome after tracheotomy in the 204 patients was as follows: 81 (39.7%) were discharged, 89 (43.6%) were referred to other hospitals, and 34 (16.7%) died. Patients with head and neck disease had the highest rates of stomal closure at discharge. Furthermore, the median interval until closure of the stoma in these patients was also significantly shorter than that in patients with non-head and neck disease. However, patients with cranial nerve disease had the highest rate of the tracheal stoma remaining open when referred to a rehabilitation hospital. Mortality rates for patients undergoing tracheotomy for cardiovascular, gastrointestinal, and respiratory diseases were high at 50.0% (11/22), 36.8% (7/19), and 26.7% (4/15), respectively.

Conclusion: When long-term airway management is required, such as in cranial nerve disease, tracheal fenestration should be performed with the aim of preventing granulation and tracheal stoma stenosis. Perioperative management must be strict, especially when performing tracheotomy in patients with cardiovascular, gastrointestinal, and respiratory diseases.

Key words

Tracheotomy, outcome, mortality

Introduction

Tracheotomy is often performed for upper airway stenosis due to acute epiglottitis or laryngeal cancer, or when respiratory insufficiency is caused by other diseases and long-term artificial respirator management is required. Many previous studies have reported complications related to tracheotomy1–4), but only a few studies have reported outcomes after tracheotomy5–7). Outcome depends on the primary disease condition in many cases. The number of patients discharged after closure of a tracheal stoma is relatively small, excluding those with upper airway inflammation and those in whom tracheotomy is performed to prevent airway stenosis during surgery for malignant tumors of the head and neck. In addition, the mortality rate is high when tracheotomy is required in patients with cardiovascular disease and respiratory disease7).

We investigated the outcomes of patients who underwent tracheotomy and how possible it was for closure of the tracheal stoma to occur. On the basis of these results, we highlighted points to note during surgery.

Patients and Methods

The subjects were 204 patients who underwent tracheotomy by otolaryngologists in St. Marianna
University School of Medicine between April 2010 and March 2015 (120 males, 84 females, mean age: 64.7 years). Among the 204 patients, the tracheal stoma could be closed in 57 (27.9%). We excluded patients who underwent tracheotomy during the process of preparing a permanent tracheal stoma such as for total laryngectomy.

Patients were classified into 6 categories according to the primary disease: head and neck disease, cranial nerve disease, cardiovascular disease, digestive disease, respiratory disease, and other disease. Among the 204 tracheotomy patients, 79 (38.7%) had head and neck disease, 45 (22.1%) cranial nerve disease, 22 (10.8%) cardiovascular disease, 19 (9.3%) digestive disease, 15 (7.4%) respiratory disease, and 24 (11.8%) had other disease. Details of the patients’ primary diseases are shown in Table 1.

We retrospectively investigated the outcome of patients who underwent tracheotomy, the rate of closure of the tracheal stoma, and the interval until closure. Whether the tracheal stoma was naturally or surgically closed was determined by the condition of the tracheal stoma. In this study, there were 15 cases of natural closure and 42 cases of surgical closure. In the case of natural closure, the interval until closure was the day when the cannula was removed. Outcome was defined as that after the admission period involving tracheotomy and was classified as discharge, referral to another hospital, and mortality. The interval until closure of the tracheal stoma was compared between head and neck disease and non-head and neck disease using the Mann-Whitney U test. In addition, the reasons affecting the interval until closure of the tracheal stoma in head and neck disease were classified as acute inflammation, prevention of airway stenosis, and others and were compared using the Kruskal-Wallis test. P-values < 0.05 were considered significant. If a significant difference was present, multiple compari-

| Table 1. Primary Diseases of the Patients |
|-----------------------------------------|
| **Head and neck disease (n=79)**        |
| Malignant tumors (including prevention of surgery-related airway stenosis) 47 |
| Inflammatory disease                    24 |
| Others (benign tumor, bilateral vocal cord paralysis, etc.) 8 |
| **Cranial nerve disease (n=45)**        |
| Cerebrovascular disorder (cerebral infarction and cerebral hemorrhage) 17 |
| Degenerative nerve disease              15 |
| Encephalitis                           6 |
| Guillain-Barré syndrome                 4 |
| Others (myasthenia gravis, etc.)       3 |
| **Cardiovascular disease (n=22)**       |
| Open-heart surgery (aortic aneurysm, aortic dissection, etc.) 15 |
| Chronic heart failure                   6 |
| Acute myocardial infarction             1 |
| **Digestive disease (n=19)**            |
| Esophageal cancer (surgical complications, tracheoesophageal fistula, etc.) 10 |
| Others (strangulation ileus, nasogastric tube syndrome, etc.) 9 |
| **Respiratory disease (n=15)**          |
| Inflammatory disease                    7 |
| Relapsing polychondritis                 3 |
| Others (lung cancer, asthma, and granulomatosis with polyangiitis) 5 |
| **Other diseases (n=24)**               |
| Idiopathic cardiopulmonary arrest       8 |
| Breast cancer (bilateral vocal cord paralysis due to metastatic lymph nodes, lung metastasis) 4 |
| Facial trauma                           2 |
| Cervical spine injury                    2 |
| Others (respiratory disorder associated with multiple organ failure) 8 |
son was performed using the Steel-Dwass test.

The study protocol was approved by the ethics review board of St. Marianna University School of Medicine prior to the beginning of this study (Approval No. 3270).

Results

Patient outcomes (Table 2)

The outcomes after tracheotomy in the 204 patients were as follows; 81 (39.7%) were discharged, 89 (43.6%) were referred to other hospitals, and 34 (16.7%) died.

Forty-five of the 81 discharged patients had head and neck disease, and the tracheal stoma could be closed in 34 of them. Most of these 34 patients had upper airway stenosis due to inflammation or surgery for malignant tumors to prevent airway stenosis.

Most of the patients referred to other hospitals had head and neck disease and cranial nerve disease. Most of head and neck diseases were due to malignant tumors. However, some patients with inflammatory disease, such as deep neck abscess, were referred to other hospitals because the tracheal stoma could not be closed due to dysphagia. Most patients with cranial nerve disease were referred to other hospitals, such as rehabilitation hospitals, with the tracheal stoma remaining open due to dysphagia.

The mortality rates in the cardiovascular, diges-

| Table 2. Patient Outcomes |
|---------------------------|
|                           | Discharge | Referral to other hospitals | Death |
| Overall (n=204)            | 81 (55)   | 89 (2)                      | 34    |
| Head and neck disease (n=79)| 45 (34)   | 28 (1)                      | 6     |
| Malignant tumors           | 21 (11)   | 21                          | 5     |
| Inflammatory disease       | 19 (19)   | 4                           | 1     |
| Others                     | 5 (4)     | 3 (1)                       | 0     |
| Cranial nerve disease (n=45)| 9 (6)     | 34 (1)                      | 2     |
| Cerebrovascular disorder   | 0         | 17                          | 0     |
| Degenerative nerve disease | 3         | 11                          | 1     |
| Encephalitis               | 4 (4)     | 2                           | 0     |
| Guillain-Barré syndrome    | 2 (2)     | 2 (1)                       | 0     |
| Others                     | 0         | 2                           | 1     |
| Cardiovascular disease (n=22) | 1 (1)     | 10                          | 11    |
| Open-heart surgery         | 0         | 8                           | 7     |
| Chronic heart failure      | 1 (1)     | 1                           | 4     |
| Acute myocardial infarction| 0         | 1                           | 0     |
| Digestive disease (n=19)   | 8 (5)     | 4                           | 7     |
| Esophageal cancer          | 5 (4)     | 4                           | 1     |
| Others                     | 3 (1)     | 0                           | 6     |
| Respiratory disease (n=15) | 8 (2)     | 3                           | 4     |
| Inflammatory disease       | 2 (1)     | 2                           | 3     |
| Relapsing polychondritis   | 3         | 0                           | 0     |
| Others                     | 3 (1)     | 1                           | 1     |
| Other diseases (n=24)      | 10 (7)    | 10                          | 4     |
| Idiopathic cardiopulmonary arrest| 3 (3)   | 4                           | 1     |
| Breast cancer              | 2         | 1                           | 1     |
| Facial trauma              | 1 (1)     | 1                           | 0     |
| Cervical spine injury      | 0         | 2                           | 0     |
| Others                     | 4 (3)     | 2                           | 2     |

The figures in parentheses indicate the number of patients in whom the tracheal stoma could be closed.
tive, and respiratory disease patients in whom tracheostomy was performed were high at 50.0% (11/22), 36.8% (7/19), and 26.7% (4/15), respectively. In contrast, the mortality rates in the head and neck and cranial nerve disease patients were low at 7.6% (6/79) and 4.4% (2/45), respectively.

### Interval until closure of the tracheal stoma (Figure 1a, b)

The median time to closure in the 57 patients in whom the tracheal stoma could be closed was 27 (range, 1–818) days.

Thirty-five of these patients were head and neck

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**Figure 1.** Interval until closure of the tracheal stoma

**a** The median interval until stoma closure in the head and neck disease patients was significantly shorter than that for non-head and neck patients (p=0.02). **b** There were no significant differences in the mean interval until closure between the 3 groups (p=0.20).
Outcomes of tracheotomy patients

Patients with cardiovascular, digestive, or respiratory disease in whom tracheotomy was performed but were low for the patients with head and neck or cranial nerve disease. There were no deaths related to tracheotomy-associated complications in any group. Shah et al.5) suggested cardiovascular disease as a factor involved in in-hospital death after tracheotomy. Hanada et al.7) also reported that the mortality rates of patients with cardiovascular, respiratory, or digestive disease at 24 weeks after tracheotomy were high. In particular, the mortality rate after open-heart surgery was 51.8% (10/17). The mortality rate after open-heart surgery at our hospital was similar at 46.7% (7/15). The cause of death in the cardiovascular, digestive, and respiratory disease groups was a result of the deterioration of respiratory and circulatory kinetics. Tracheotomy is frequently performed for patients with an unfavorable general condition, and surgical invasiveness may cause a rapid change in condition. Therefore, we request the anesthesiologist to examine the patient’s condition before surgery to determine whether surgery is possible and to conduct strict perioperative management. In particular, concerning tracheotomy following open-heart surgery, several studies reported that tracheal stoma infection involving the mediastinum increased the mortality rate9,10. To prevent infection, an upper tracheotomy should be selected. For patients with obesity, a short neck, or low-set larynx, cricoid fenestration must be selected, as reported by Kano and Hasegawa11.

Conclusion

We clinically investigated the outcome of 204 patients who had undergone tracheotomy and how possible it was for closure of the tracheal stoma to occur. Outcome after tracheotomy in the 204 patients showed that 81 (39.7%) were discharged, 89 (43.6%) were referred to other hospitals, and 34 (16.7%) died. Patients with head and neck disease had the highest rates of stomal closure at discharge, and their median interval until closure of the stoma was also significantly shorter than that in patients with non-head and neck disease. Mortality rates for patients undergoing tracheotomy for cardiovascular, gastrointestinal, and respiratory diseases were high at 50.0% (11/22), 36.8% (7/19), and 26.7% (4/15), respectively. In the future, we will continue to collect cases and perform sub-analysis and multiple comparison that include other factors.
Conflicts of interest
The authors have nothing to disclose.

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