Management of Malignant Esophagotracheal Fistulas With Airway Stenting and Double Stenting*

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Prognosis of inoperable or recurrent esophageal carcinoma is, at best, poor. Once an esophagotracheal fistula has developed, the overall condition of the patient declines rapidly. Aspiration pneumonia and severe coughing are common. The introduction of esophageal tubes does not always seal the fistula sufficiently and may compromise the airway causing stridor rapidly. In 30 patients (25 male, 5 female; age 23 to 74 years; mean, 56 years) with very large fistulas and airway problems, we inserted an airway stent (Dynamic) (n=12) or an esophageal tube combined with a Dynamic airway stent (n=18) with the aim of sealing the fistula and restoring patency of the airway and GI passage. The tracheobronchial Dynamic stent was chosen because its slightly concave, flexible posterior silicone membrane adapts ideally to the convex esophageal tube. The stents were well tolerated and significantly improved the quality of life. Of 30 patients, 16 could breathe and swallow unimpaired until shortly before their death. Moderate complaints persisted in five patients, dysphagia in eight patients, and dyspnea in one patient. Mean survival time in the double stent group was significantly greater (110 days) than in the airway stent-only group (24 days) or comparable groups in the literature treated with esophageal tubes only. We conclude that carefully selected patients can benefit from double stenting of esophagus and airways. (CHEST 1996; 110:1155-60)

Key words: airway prosthesis; double stenting; Dynamic stent; esophageal cancer; esophageal prosthesis; esophagotracheal fistulas

With 5-year survival below 1%, recurrent or inoperable esophageal cancer has a poor prognosis.1-3 Once an esophageal-airway fistula has developed, the overall condition of the patient declines rapidly and death can be expected within days, unless sealing of the fistula can be achieved.4-6 Such a malignant communication between the trachea and esophagus is a particularly distressing complication in a patient who may already have other problems of advanced localized malignancy such as pain, dysphagia, and cachexia. Whenever the patient swallows, aspiration of esophageal content into the bronchial tree causes severe coughing. The continual aspiration and coughing result in exhaustion and pneumonia.

Besides laser therapy, brachytherapy, and photodynamic therapy,7,8 the most common palliative approach to restore patency in cases of tumor obstruction is the peroral placement of esophageal prostheses of various shapes.9-14 These devices are also used with the intention of sealing fistulas between the alimentary and respiratory tract.15-18 Despite all efforts, most patients die of pulmonary complications, mainly as a result of insufficient sealing and persistent aspiration. Another problem is a possible compromise of the airways by the cancer or the esophageal prosthesis itself.18-21 In cases of severe tracheobronchial obstructions, the pulmonologist becomes involved and recent reports suggest double stenting to be a promising option.22 We report our experience with airway stenting and double stenting in 30 patients with large esophagotracheal fistulas and pulmonary symptoms.

Materials and Methods

Patient Population

Between May 1990 and May 1994, thirty dynamic airway stents were inserted in patients with esophagotracheal fistulas. The patients studied included 25 men and 5 women with ages ranging from 23 to 74 years (mean, 56 years). Twenty-seven patients had primary esophageal cancer and 3 patients other thoracic cancers, secondarily involving the esophagus. All fistulas in this series were located between the second cartilage ring and the main carina and size ranged from 1 to 4 cm in diameter. Two fistulas were considered sequelae from radiation therapy, whereas in most cases (28), fistulas were due to the direct extension of malignant tissue. Therapies prior to the airway stent placement included surgical intervention (three), radiotherapy (three), chemotherapy (five), percutaneous endoscopic gastroscopy (five), esophageal mettal stents (eight), foam rubber cuff tubes (five), and Celestin and Atkinson tubes (five). Decisions whether an esophageal prosthesis should be placed were made by the gastroenterologist based on symptoms and life expectancy of the patient. The main concern was the risk of the procedure. In cases of complete obstruction and sufficient nutrition...
Stent Placement

The Dynamic stent (Rüsch Y stent; Willy Rüsch AG; Kernen, Germany) is a bifurcated tracheobronchial prosthesis developed in our department. It is made of silicone with incorporated steel struts resembling the horseshoe-shaped cartilages. A flexible posterior silicone membrane can bulge inwardly during coughing and thus facilitates mucus clearance. All procedures were performed under general anesthesia using rigid bronchoscopes and esophagoscopy (Storz; Tuttlingen, Germany). In cases of intraluminal tumor growth, YAG-laser (Dornier; Munich, Germany) photolysis was performed. The Dynamic stent was placed using special stent introducer forceps. In five patients, a cuffed esophageal prosthesis (WCEP 10.4; William Cook Europe; Mönchengladbach, Germany) was inserted in the same session, following dilatation with Savary-Gilliard bougies (Wilson Cook; Winston-Salem, NC). In these patients, a percutaneous endoscopic gastrostomy tube (Frese¬nium; Bad Homburg, Germany) was also used. In three patients in whom the funnel of a formerly placed esophageal tube had perforated the tracheal wall (Figs 1 through 3), the prostheses had to be replaced by a longer model using a tube repositioner (William Cook; Europe) and a Nottingham introducer (Olympus; Tokyo, Japan) before the Dynamic stent could be inserted. The positions of airway and esophageal prostheses were confirmed with flexible endoscopes (Olympus and Pentax; Tokyo, Japan) and a lateral radiograph (Fig 4). All patients were referred back to their local hospitals in the afternoon of the same day.

Data Acquisition and Analysis

Data were collected retrospectively by chart review. As none of the patients had been diagnosed, pretreated, or followed up in our hospital, we depended on the information provided by the treating physicians. All files were checked for complaints, complications, survival, and cause of death. A detailed grading of dysphagia according to the Takita score was not possible due to inadequate information. We were able to distinguish among three groups with statements such as “could swallow soft food” as minimal or solid food dysphagia (Takita I to II), “could only swallow their own saliva” as moderate complaints (Takita III to V), and “unable to swallow saliva” (Takita VI). Survival times are displayed as fraction of survivors and group differences analyzed using the Mann-Whitney U test.

Results

All airway stents were well tolerated. Two patients who were ventilator-dependent prior to the procedure due to respiratory insufficiency following aspiration pneumonia did not recover and died within 5 days. All others were discharged from the hospital at various times.

Table 1 summarizes the functional results. If soft food could be digested, it was classified as “solid food dysphagia;” if only saliva could be swallowed, it was classified as “moderate complaints.” There were no clinical signs of aspiration in these 21 patients.

Complications

One Dynamic stent migrated cephalically, but was easily repositioned with a rigid bronchoscope. In four very weak patients, retained secretions required repeated suctioning within the first 2 weeks. Three dislodgements of the esophageal prosthesis were observed. Two tubes could be repositioned, one remained in the stomach. No mediastinitis was reported, but most of the patients were given antibiotics prophylactically.
**Figure 3.** Dynamic stent in the trachea; same patient as in Figure 4. The flexible posterior membrane covers the defect and counteracts the compression of the esophageal tube.

**Cause of Death**

No deaths were directly attributable to the stent placement. As mentioned before in the “Results” section, two ventilator-dependent patients died without regaining consciousness. In four patients with advanced cancer, massive bleeding with hematemesis and hemoptysis resulted in sudden deaths. No other suffocations were reported. Table 2 summarizes the causes of death of the patients.

**Survival**

Survival times are shown in the survival chart (Fig 5), grouped for patients who had been treated with an airway stent or with esophageal tube plus airway stent. Survival in the tracheal stent group (mean±SEM, 23.8±10.1 days) was significantly different (p=0.0027) from that of the double-stent group (110.2±30.8 days).

**Table 1—Complaints After Airway Stenting or Double Stenting**

<table>
<thead>
<tr>
<th>Complaints</th>
<th>No Esophageal Stent</th>
<th>Metallic Esophageal Stent</th>
<th>Silastic Esophageal Stent</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid food dysphagia</td>
<td>4</td>
<td>3</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Moderate complaints</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Persisting dysphagia</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Persisting dyspnea</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dysphagia and dyspnea</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>12</td>
<td>8</td>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>

**Figure 4.** Oblique chest radiograph showing the position of the bifurcated airway stent and the esophageal cuff prosthesis.

**DISCUSSION**

A plethora of esophageal tubes has been used with the intention of restoring alimentary continuity and of sealing tracheoesophageal fistulas. End-stage esophageal cancer and esophagorespiratory fistulas are usually treated in departments of gastroenterology or abdominal surgery, where bronchoscopy is a less common procedure. Most of the patients in the reported group had not undergone bronchoscopy before being referred to us. Working in a specialized pulmonary hospital, our referrals comprise a very select group of patients with marked pulmonary symptoms. The symptoms resulted from persisting chronic aspiration or extrinsic compression of the trachea accompanied by stridor and dyspnea. If esophageal stents are used, particularly when positioned in the cervical esophagus,

**Table 2—Causes of Death**

<table>
<thead>
<tr>
<th>Causes of Death</th>
<th>No.</th>
</tr>
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<tbody>
<tr>
<td>Weakness due to tumor progress</td>
<td>17</td>
</tr>
<tr>
<td>Respiratory insufficiency</td>
<td>5</td>
</tr>
<tr>
<td>Bleeding</td>
<td>4</td>
</tr>
<tr>
<td>Cardiac insufficiency</td>
<td>2</td>
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<tr>
<td>Pneumonia</td>
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possible obstruction of the trachea must considered, due to the close proximity of the structures at this level.\textsuperscript{20,21} Although not the intended focus of this article, it is debatable whether esophageal tubes should be placed at all in these patients.\textsuperscript{26} Confronted with esophageal tube perforations in the trachea or with extrinsic airway compression, the situation calls for the insertion of an airway stent. The placement of tracheal stents has become an established method to counteract extrinsic airway compression.\textsuperscript{27-31} Double stenting of esophagus and airways has also been described\textsuperscript{32} by a group using silicone stents (Dumon)\textsuperscript{28} in five patients. Recently another approach has been suggested,\textsuperscript{32} namely that, instead of a foam-cuffed esophageal prosthesis, a tailored bifurcated tracheal stent with a foam cuff is used to seal an esopagotracheal fistula. This could be an option if restoration of the airway passage is the main or sole concern. While we also have had very good results with the cylindrically shaped Dumon stents in cases of malignant airway compression,\textsuperscript{29} for the patients with fistulas, we opt for the Dynamic stent because of its shape. We reason that the slightly concave flexible membrane adapts better to the convex shape of an esophageal prosthesis or its cuff than round (convex) shaped silicone or metallic stents (Fig 6) and expect a better seal of the fistulas. Another advantage of this bifurcated stent is the lower risk of migration as it saddles the carina. Our observed dislodgement probably resulted from initially selecting the wrong size (14-mm, instead of 16-mm diameter). In a larger series of 150 placements of bifurcated Dynamic stents, we observed a total of 4 migrations, all with small-sized stents.

Esophageal tubes and airway stents can be placed under local anesthesia with flexible endoscopes.\textsuperscript{13,14,16,17,31,33,34} However, in our opinion, using rigid instruments facilitates the procedures, at least in the airways. A possible obstruction from the cuff or funnel of the esophageal tube can be managed faster and more safely with the rigid bronchoscope.

Though a large number of articles on the use of esophageal prostheses have been published, little sta-

\begin{figure}
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\includegraphics[width=\textwidth]{figure5.png}
\caption{Survival times.}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{Cuffed esophagus prosthesis and Dynamic airway stent with flexible concave posterior membrane.}
\end{figure}
statistically relevant data are available about survival times. In a collective review by Duranceau and Jamieson, there was no comparably large group of patients. Of 14 authors, only 2 reported on more than 4 patients. Survival times ranged from 5 days to 9 months. In a series of ten patients treated with double stenting,22 only a single patient had an esophagotracheal fistula. He lived for 186 days, but more detailed information was not available. In a group of ten patients treated with a cuffed esophageal tube,17 three had a tracheal-oesophageal fistula, comparable to the ones we report herein. Mean survival time was 37 days. When judging our mean survival time of 110 days in the double-stent group, it must be considered that we count from the day of tracheal stent insertion and not from the day of esophageal tube placement as in the quoted studies. Thirteen of our patients already had their esophageal prosthesis for periods of between 3 days and 3 months at presentation. Survival times between the group of patients who received only an airway stent and the double-stent group were found to be significantly different. However, a certain bias has to be considered, as the morbidity of the patients without an esophageal stent was certainly higher. Among them were those patients who had developed a recurrence following esophagectomy and patients in whom the disease was already so advanced that a tube placement was no longer considered reasonable.

Although only limited information is available from the patients’ files, there can be no doubt that an improvement in the quality of life was achieved. Consisting of the extent of the disease and the poor condition of the patients prior to stent placement, we believe that most of the patients benefited from the procedure. In at least 21 patients, aspiration was reduced to a clinically insignificant level. A clear advantage between the single-stent group and the double-stent group could not be demonstrated for symptom relief. As airway patency could be achieved with the placement of the Dynamic stent in both groups, the prolonged survival time indicates, at least to some degree, that aspiration pneumonia might be prevented better by the combined treatment. While stenting appears to be helpful in this group, we cannot recommend airway stenting for those patients with malignant fistulas who have already become ventilator-dependent. To validate the results of this retrospective study, a prospective multicentric study should be performed.

CONCLUSION

We conclude that double stenting using an esophageal prosthesis and a Dynamic airway stent can improve the quality of life and improve survival time in patients with large esophagoairway fistulas.

References

28 Dumon JF. A dedicated tracheobronchial stent. Chest 1990; 97:328-32