Diagnosis and consequences of gastroesophageal reflux in otolaryngology
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Chapter 5

Gastropharyngeal and Gastroesophageal Reflux after Total Laryngectomy

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ABSTRACT

Gastroesophageal reflux (GER) appears to be related to laryngeal carcinoma. Little is known about GER and gastropharyngeal reflux (GPR) in the laryngectomized patient. Therefore, GER and GPR were studied in laryngectomized patients.

In 11 patients 24-hour double-probe pH monitoring was performed in an ambulant setting. An optic fiberscope was used for the accurate positioning of the proximal probe in the upper esophageal sphincter.

In 9 of 11 patients pathologic GPR was found. Four of these 9 patients had reflux in upright and supine position. 5 patients had reflux only in upright position.

A high prevalence of GPR in laryngectomized patients was found. These results raise the question whether all laryngectomized patients should be investigated for reflux and in the presence of pathologic reflux findings should be treated with reflux prophylaxis.
INTRODUCTION

Gastroesophageal reflux (GER), resulting in gastropharyngeal (GPR, also named laryngopharyngeal) reflux, appears to be associated with various otolaryngological disorders such as globus pharyngeus, dysphonia, dysphagia, chronic throat-clearing, posterior laryngitis, laryngeal granulomas, and subglottic stenosis. It might even be an etiologic factor in the pathogenesis of carcinomas of the aerodigestive tract. Little is known about GER and GPR in the laryngectomized patient. Animal studies have shown that gastric fluids may cause severe damage to upper airway mucosa. Therefore, GPR may cause voice problems in the laryngectomized patient or lead to an increase of mucositis during radiotherapy and an increased incidence of pharyngocutaneous fistula after laryngectomy. The role of GER in successful esophageal voicing in the laryngectomized patient has been discussed in the past. However, these studies were not performed with ambulatory 24-hour double-probe pH monitoring and did not evaluate GPR. In these studies, GER was discovered by fluoroscopy of the esophagus, the Bernstein perfusion test, or short term pH testing. Nowadays, the best method to demonstrate GER is ambulatory 24-hour pH monitoring.

To reveal the prevalence of GER and GPR after total laryngectomy we performed ambulatory 24-hour double-probe pH monitoring in total laryngectomized patients.

PATIENTS AND METHODS

Eleven asymptomatic laryngectomized patients, 10 men and 1 woman (mean age, 64.5 years; range, 48-83 years), were studied. These patients visited our outpatient clinic for regular checkup and were asked to participate. All patients had a neurectomy of the pharyngeal plexus and primary tracheoesophageal (TE) puncture with insertion of a Provox (Atos Medical AB, Hörby, Sweden) voice prosthesis. Ten patients underwent a laryngectomy because of laryngeal carcinoma and one because of a chondroma of the larynx. All but two patients (one with chondroma of the larynx and one with laryngeal carcinoma) had had radiotherapy before or after laryngectomy. The average time between the laryngectomy and the pH measurement was 1.4 years (range, 0.5-2.5 years).

pH measurement:
Double-probe pH monitoring was performed with two monocryalline antimony pH sensors positioned along a single catheter (diameter 2.1 mm) with the sensors 15-20 cm apart and a silver-silver chloride cutaneous reference electrode (Digitraper...
Mark III, Medtronic Synectics, Maastricht, The Netherlands). Both probes (pH sensors) were calibrated simultaneously in buffer solutions pH 7 and pH 1 before monitoring. A flexible laryngoscope was introduced transnasally until a good view of the hypopharynx was achieved. Under endoscopic view, the proximal probe was placed in the upper esophageal sphincter (UES) so that the proximal probe was just surrounded by esophageal mucosa. A recent study showed that endoscopic placement of the proximal probe in the UES without manometry is an accurate method. Accordingly, the second probe (distal pH sensor) was positioned 15 or 20 cm distal of the proximal probe, depending on the height of the patient. Exact positioning of the distal probe was of lesser importance because the distal probe was primarily used to detect real reflux episodes (i.e. a pH drop at the distal probe preceding a pH drop at the proximal probe) at the level of the UES. The distance from the tip of the nose to the lower esophageal sphincter (LES) was determined using the pH transition point (withdrawal technique) to get an impression of the position of the distal probe (distance above LES).

The patients were encouraged to eat their regular meals without restrictions and to continue their normal daily and nocturnal routines. In a diary, the patients reported body position, meals, and drinks.

Data analysis:
For the distal probe, the criteria of Richter et al. were used to distinguish between physiologic and pathologic reflux. The authors defined as normal: pH below 4 less than 5.5% of the total time, less than 8.2% of the time in upright position, and less than 3% of the time in supine position. Fewer than four reflux episodes of more than 5 minutes' duration and a maximal reflux episode of 19 minutes were allowed.

For the proximal probe, placed at the entrance of the esophagus, the normal values as recently established were used: in 20 healthy subjects, hardly any period of pH less than 4 was found at the level of the UES.

For the total time of pH below 4 in 18 out of 20 subjects, no period was found in which the pH dropped below 4. In the remaining two subjects, it was found during 0.1% of the total time.

For the time of pH below 4 in the upright position in 17 out of these 20 subjects, no period was found in which the pH dropped below 4. In the remaining three subjects, it was found in two for 0.1% and in one for 0.2% of the time in upright position.

For the time of pH below 4 in the supine position in all subjects, no period was found in which the pH dropped below 4.

Because our recording device measures time with pH below 4 in steps of 0.1%, we have to consider any recorded period of 0.2% or higher as pathologic for the
total time, any recorded period of 0.3% or higher as pathologic for the time in upright position and any recorded period of 0.1% or higher as pathologic for the time in supine position.

Table 1. Percentage of time pH < 4 during dual-probe, ambulatory 24-hour pH monitoring

<table>
<thead>
<tr>
<th>Patients</th>
<th>Total</th>
<th>Upright</th>
<th>Supine</th>
<th>Total</th>
<th>Upright</th>
<th>Supine</th>
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<tr>
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<td>0.0</td>
<td>11.9</td>
<td>18.1</td>
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<tr>
<td>3</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>4.6</td>
<td>5.5</td>
<td>2.8</td>
</tr>
<tr>
<td>4</td>
<td>12.1</td>
<td>14.6</td>
<td>6.2</td>
<td>24.2</td>
<td>29.0</td>
<td>12.6</td>
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<tr>
<td>5</td>
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<td>2.6</td>
<td>0.5</td>
<td>13.7</td>
<td>16.9</td>
<td>4.8</td>
</tr>
<tr>
<td>6</td>
<td>0.9</td>
<td>1.6</td>
<td>0.0</td>
<td>15.2</td>
<td>16.4</td>
<td>13.6</td>
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<tr>
<td>7</td>
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<td>0.5</td>
<td>0.0</td>
<td>3.6</td>
<td>5.4</td>
<td>0.0</td>
</tr>
<tr>
<td>8</td>
<td>1.6</td>
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<td>16.1</td>
<td>40.1</td>
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<tr>
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<td>0.2</td>
<td>0.7</td>
<td>19.8</td>
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<td>27.6</td>
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<tr>
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<td>0.0</td>
<td>1.6</td>
<td>1.9</td>
<td>0.6</td>
</tr>
<tr>
<td>11</td>
<td>0.3</td>
<td>0.4</td>
<td>0.0</td>
<td>2.7</td>
<td>3.4</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Pathologic gastropharyngeal reflux: pH < 4 more than 0.1% of the total time, more than 0.2% of the time in upright position and more than 0.0% of the time in supine position.
Pathologic gastroesophageal reflux: pH < 4 more than 5.5% of the total time, more than 8.2% of the time in upright position and more than 3.0% of the time in supine position.

RESULTS

The distance of the distal probe from the pH transition point varied from 5 to 11.5 cm.
In table 1, the percentage of time pH below 4 is shown for the total time and the time in upright and in supine position of the proximal probe (measuring the GPR) and distal probe (measuring the GER).
Seven of 11 patients (64%) had a pathologic GER. Five of these patients had reflux in upright and in supine position; the other two patients had reflux only in upright position.
According to our established criteria, 9 of 11 patients (82%) had too many periods of pH below 4 at the level of the UES (GPR). Four of these 9 patients had reflux in upright and in supine position. Five of the 9 patients had reflux only in the upright position. All 7 patients with a pathologic GER had also pathologic values at the level
of the UES (GPR). In 2 patients with pathologic values at the level of the UES (GPR), pathologic GER could not be detected.

Of the two patients who did not receive radiotherapy, the patient with a laryngeal carcinoma (patient no. 10) had normal proximal and distal pH values, whereas the patient with a chondroma of the larynx (patient no. 5) had pathologic values for both.

**DISCUSSION**

To assess GER, the distal pH probe is usually positioned 5 cm above the LES. To approximate the position of the distal pH probe above the LES, we used the pH transition method (withdrawal technique). The disadvantage of this method is that the pH probe probably lies in a more proximal position compared to the ideal manometrically determined position. Furthermore, in some of the patients, the distal probe was located more than 5 cm above the pH transition point, because the distance between the probes was fixed at 15 or 20 cm and accurate positioning of the proximal probe was mandatory. Both factors might underrated the pathologic GER in the distal esophagus. Yet we found in 7 of 11 patients a pathologic GER.

The proximal probe was positioned in the UES at the entrance of the esophagus, assuring relation to the hypopharynx was as close as possible. Nine of 11 patients had pathologic reflux episodes at the level of the UES. Five of these 9 patients had reflux only in the upright position.

This finding of a high prevalence of reflux at the level of the UES in upright position agreed with the findings of Koufman et al. who found a commonly occurring reflux during daytime.

Two of the nine patients with pathologic GPR had a physiologic reflux in the distal esophagus (table 1, patients no. 7 and 11). Some of the physiologic reflux episodes in the distal esophagus reached the UES, resulting in pathologic values for GPR.

The high prevalence of GPR and GER in the laryngectomized patient might be explained by disturbance of the complex antireflux barrier. The most important components of the antireflux barrier are: the LES tone, esophageal acid clearance, esophageal epithelial resistance, and UES tone. Salivary secretion also influences the antireflux barrier. During laryngectomy, neururectomy of the pharyngeal plexus and/or myotomy of the cricopharyngeal muscle is deliberately performed to facilitate postsurgical voice rehabilitation. These procedures, aimed at decreasing the UES tone, may simultaneously decrease one of the last ultimate antireflux barriers for GPR. Furthermore, radiotherapy for head and neck malignancies influences the salivary secretion, thereby compromising another reflux barrier.

The two patients with physiologic reflux episodes in the distal esophagus and pathologic values for GPR received radiotherapy. Probably, a part of the antireflux
barrier was compromised (esophagus clearance, salivary secretion).

The finding of a high prevalence of reflux after total laryngectomy indicates that reflux might play a role in complications after surgery, during radiotherapy, and in voice rehabilitation. Preoperative assessment of GPR and GER and follow-up after surgery may elucidate the impact of reflux. The adequacy of efforts to prevent or to treat reflux should be assessed as well.

CONCLUSION

A high prevalence of GPR and GER in laryngectomized patients was found. This observation may be related to preexistent pathologic changes or to the extensive surgery and the herewith associated changes in physiology. The extent and the clinical significance of mucosal damage and its role in postoperative and postradiation complication are as yet unknown, as is the role of reflux in the development of laryngeal cancer. However, our results indicate that laryngectomized patients should be investigated for GER and GPR and probably might be treated with reflux prophylaxis to prevent tissue damage. Also, prospective reflux investigations, both before and after surgery, might answer the question whether reflux is mediated by surgery or was already present.
REFERENCES


