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*Original Article*

# Treatment of postoperative intrathoracic reconstruction after digestive tract fistula in esophageal and cardiac carcinoma

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**Abstract:** Objective: Anastomotic leakage and thoracic-gastric leakage, collectively known as leakage of the thoracic esophageal anastomosis, remains one of the most severe postoperative complications of esophagoctomy and esophagogastrostomy. We proposed and tested a treatment strategy consisting of staging and fistulation. Methods: The clinical records of 23 patients with intrathoracic reconstruction fistula after esophagectomy or esophagogastrostomy from 1998 to 2014 were analyzed retrospectively. We classified the patients into 1 of 2 groups: Group A consisted of 12 patients treated immediately with the traditional "3-tubes therapy": a closed thoracic drainage tube, a Miller-Abbott tube, and an enteral nutrition tube after diagnosis. Group B consisted of 11 patients treated with our staging and fistulation therapy, which consists of classification, treatment, cultivation, and narrowing and closing the fistula. The treatment duration and mortality rate were observed. SPSS 20.0 was used in analyzing the data. $P<0.05$ was considered statistically significant. Results: Twenty patients recovered, and 3 patients died. The average treatment duration of group B (27±5.81) was shorter than that of group A (41.3±14.3). Therapeutic efficacy was also more obvious in group B ($P<0.05$). The mortality rate was not statistically different between the groups ($P>0.05$). Conclusions: Treatment of postoperative intrathoracic esophageal anastomotic leaks should be individualized. Evaluation, staged treatment, cultivation, and narrowing and closing of the fistula are essential to staging and fistulation therapy.

**Keywords:** Cardiac carcinoma, esophageal carcinoma, intrathoracic esophageal anastomotic leaks

## Introduction

Anastomotic leakage and thoracic-gastric leakage remain the most severe postoperative complications of esophagoctomy and esophagogastrostomy. With similar symptoms and treatment, they are collectively known as leakage of the thoracic esophageal anastomosis. With advancing medical standards, the incidence and mortality has obviously decreased. However, compared with other complications, it still remains one of the most common causes of death.

The use of a chest/mediastinum closed drainage tube, nasogastric decompression tube, and enteral nutrition tube is well-known as "3-tubes therapy" in general thoracic surgery; this type of therapy is the conventional treatment for postoperative fistula [1-6]. Here, we introduce a therapeutic strategy of staging and fistulation for postoperative digestive tract leaks in cancer of the upper digestive tract.

## Materials and methods

### *Patients*

We retrospectively studied the clinical records of 23 patients with cancer of the upper gastrointestinal tract complicated by intrathoracic postoperative digestive tract fistula from 1998 to 2004. Fifteen patients had esophageal carcinoma; 8 had cardiac carcinoma; 16 had anastomotic fistula; 6 had thoracic gastric fistula; 15 were men; and 8 were women. Ages ranged from 38 to 76 years.

The surgical method was mechanical anastomosis. Fifteen patients underwent esophago-

**Table 1.** General conditions and clinical characteristics of patients treated in our center

| | Group A | | Group B | | $\bar{X}$ value or t value | *P* value |
|---|---|---|---|---|---|---|
| Age ($\bar{X}$ ±s) | 59.8±8 (t=0.219, P=0.304) | | 59.2±6.1 (t=1.059, P=0.304) | | | |
| | Number of patients | Percentage | Number of patients | Percentage | | |
| Sex | | | | | | |
| Male | 9 | 75 | 6 | 54.5 | | |
| Female | 3 | 25 | 5 | 45.5 | | |
| Fistula | | | | | 0.023 | 0.879 |
| Anastomotic fistula | 8 | 66.7 | 7 | 63.6 | | |
| Thoracic gastric fistula | 4 | 33.3 | 4 | 36.4 | | |
| Pathological type | | | | | 0.009 | 0.924 |
| Squamous cell carcinoma | 10 | 83.3 | 9 | 81.8 | | |
| Adenocarcinoma | 2 | 16.7 | 2 | 18.2 | | |
| Site | | | | | 0.009 | 0.924 |
| Esophageal carcinoma | 10 | 83.3 | 9 | 81.8 | | |
| Cardiac carcinoma | 2 | 16.7 | 2 | 18.2 | | |
| Staging | | | | | 0.048 | 0.827 |
| Stage II | 6 | 50 | 6 | 54.5 | | |
| Stage III | 6 | 50 | 5 | 45.5 | | |
| Procedure | | | | | 0.023 | 0.879 |
| Supra-arch anastomosis | 8 | 66.7 | 7 | 63.6 | | |
| Intra-arch anastomosis | 4 | 33.3 | 4 | 36.4 | | |
| Duration of surgery and complications (d) ($\bar{X}$ ±s) | 11.2±10.5 | | 13.7±11.4 | | t=-0.561 | 0.581 |

**Table 2.** Treatment duration ($\bar{X}$ ±s) and mortality rate with two therapies

| | Patient number | Treatment duration (d) | | Mortality rate (%) |
|---|---|---|---|---|
| | | $\bar{X}$ ±r | Median | |
| Group A | 12 | 41.3±14.3 | 43 | 2 (16.7%) |
| Group B | 11 | 27±5.81 | 26 | 1 (9.1%) |
| t value | | 3.169 | | 0.29 |
| *P*-value | | 0.0046 | | 0.590 |

gastrostomy above the aortic arch, and 8 underwent esophagogastrostomy below the aortic arch (**Table 1**).

*Diagnostic approach*

The patients were imaged using fluoroscopy after administration of 2% oral meglumine diatrizoate. Violet liquid could be observed when patients were given methylenum coeruleum. We then performed gastroscopy.

*Treatment*

Patients with thoracic esophageal anastomosis fistula were randomly assigned to an observation group or a control group, depending on age, sex, procedure, pathology, tumor types, fistula site, and the interval between the surgery and complications. Group A patients were treated immediately with the traditional 3-tubes method. Group B patients were treated with staging and fistulation therapy.

*Stage I features:* 1) Closed drainage of the thoracic cavity, mediastinal drainage, external drainage of the fistula via a gastric tube, or internal drainage of the fistula; 2) Parenteral and enteral nutrition support; 3) High thoracic washing to reduce infections in the chest cavity [7]; 4) Coughing and expectoration was encouraged to help reduce the risk of infection, promote inflation, and decrease the residual cavity.

*Stage II features:* 1) The mode of biliary drainage was closed or mediastinal drainage. Pleural cavity open drainage can be used in some patients with an indwelling gastric tube; 2) Enteral nutrition is given priority over peripheral parenteral nutrition [8]; 3) High thoracic washing was stopped to stimulate pleurodesis and eliminate the residual cavities [9]; 4) Fiberboard was formed on the surface of the lung tissue.

**Table 3.** Clinical features of intrathoracic anastomotic leakage in different stages: time limitation, treatment method, and purpose

| Stage | Clinical features | Time | Therapeutic measures | Aim |
|---|---|---|---|---|
| I | Acute symptoms of infection, including fever and chest pain; decreased breath sounds and a lack of bowel sounds.<br>Pneumothorax or liquid pneumothorax is indicated by computed tomography<br>Blood tests suggest an acute infection. | 1 or 2 weeks | Drainage: closed drainage of the thoracic cavity, mediastinal drainage, or external drainage of fistula, gastric tube, or internal drainage of fistula<br>Nutrition: parenteral and enteral support<br>High thoracic washing to reduce infections in the chest cavity<br>Respiratory nursing: cough and expectoration is encouraged in order to reduce the risk of infection, promote inflation, and decrease the residual cavity | Control intrathoracic infection and promote adequate drainage and atelectasis |
| II | Normalized temperature with controlled infection<br>Pneumothorax reduction checked by computed tomography<br>Recovery of bowel sounds<br>Unhealed leaks | 3 or 4 weeks | Mode of biliary drainage: thoracic closed drainage and mediastinal drainage is mainly used in this stage. Pleural cavity open drainage can be used in some patients with an indwelling gastric tube<br>Nutritional support: Enteral nutrition is given priority over peripheral parenteral nutrition<br>High thoracic washing: stop washing to stimulate pleurodesis, helping eliminate the residual cavities<br>Respiratory care: fiberboard is seen on the surface of the lung tissue. To prevent atelectasis, patients were advised to walk<br>Postoperative diet: diet can be taken into consideration when peristaltic sounds are recovered. However, much more attention should be given to the influence of posture | Reduced residual cavity, cultivate the fistula opening, and promote atelectasis |
| III | Fistula formation<br>Intrathoracic stability<br>Extensive intrathoracic adhesion | After 4 weeks | | Fistula narrowed and plugged, leak closure |

To prevent atelectasis, patients were advised to walk; and 5) The postoperative diet can be considered when peristaltic sounds are recovered. However, much more attention should be given to the influence of posture.

*Stage III features:* 1) Mediastinal drainage or external drainage of fistula without a gastric tube; 2) Enteral nutrition was used and is preferred in these patients; and 3) By regularly changing the drainage tube, the fistula was gradually narrowed.

*Statistical methods*

Data were analyzed using SPSS 20.0. Measurement data was described by the mean ± standard deviation ($\bar{x}\pm s$). Statistical analyses of the data, which involved an independent-sample t-test, were conducted on the primary data from the follow up. Analysis of variance (ANOVA) was used to analyze means of Aples. A *P*-value less than 0.05 was considered statistically significant. No statistically significant difference was observed between the groups ($P>0.05$) (**Table 1**). While evaluating treatment duration (from diagnosis to discharge) and the mortality rate, a statistically significant difference was found ($P<0.05$).

## Results

Twenty patients recovered, and 3 patients died, 1 from multiple organ dysfunction and 2 from abdominal hemorrhage. The mortality rate between the two groups was not statistically significant ($P>0.05$) (**Table 2**). The average duration of fistula treatment and median (27±5.81) of group B (staging and fistulation) was shorter than that of group A (3-tubes therapy) (41.3±14.3). In the treatment group (group B), serum protein levels improved more than in the control group (group A), and the difference was statistically significant ($P<0.05$).

The mortality rate between the two groups was not statistically significant ($P>0.05$) (**Table 2**). The average fistula treatment duration and median (27±5.81) in group B (staging and fistulation) was shorter than that of group A (3-tubes therapy) (41.3±14.3). In the treatment group (group B), serum protein levels improved more than in the control group (group A), and the difference was statistically significant ($P<0.05$).

## Discussion

Anastomotic leakage and thoracic-gastric leakage, collectively known as leakage of the thoracic esophageal anastomosis, have similar symptoms and treatment, regardless of etiology. We retrospectively reviewed the medical records of 23 patients with thoracic esophageal anastomoses and analyzed the treatment strategies.

Few studies have been done on the treatment of postoperative anastomotic fistula in patients

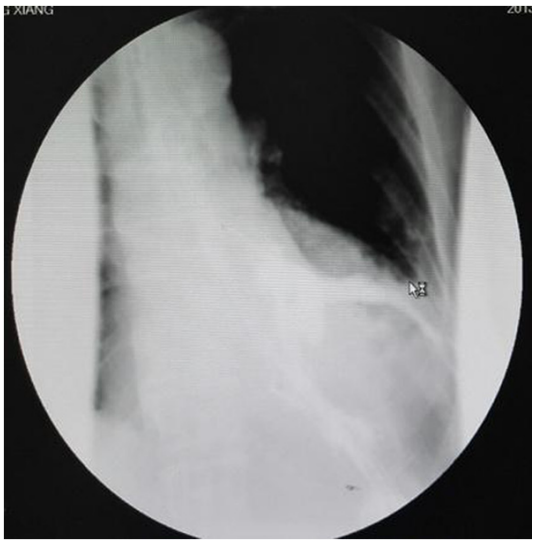

**Figure 1.** Stage II thoracic-gastric fistula: a wide fistula formation imaged using meglumine diatrizoate.

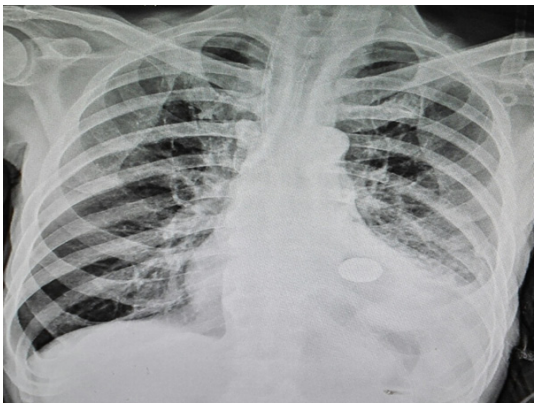

**Figure 2.** Stage III thoracic-gastric fistula: The fistula is blocked by the water sac of the Foley catheter injected with contrast agent. The water sac is medial to the thoracic-gastric fistula. To achieve the goal of narrowing the fistula, the catheter should be replaced by progressively thinner ones.

with esophageal or cardiac cancer. Depending on the fistula stage, we cultivated and closed the fistula. Appropriate staging is important in the choice of treatment. The clinical characteristics of the patients treated in our center are introduced below (**Table 3**).

*Stage I clinical features (weeks 1 and 2 after fistulation:* Acute symptoms of infection, including fever and chest pain; decreased breath sounds and lack of bowel sounds; pneumothorax or liquid pneumothorax, as shown by computed tomography (CT); and blood tests suggesting an acute infection. The aim was to control intrathoracic infection and promote adequate drainage and atelectasis.

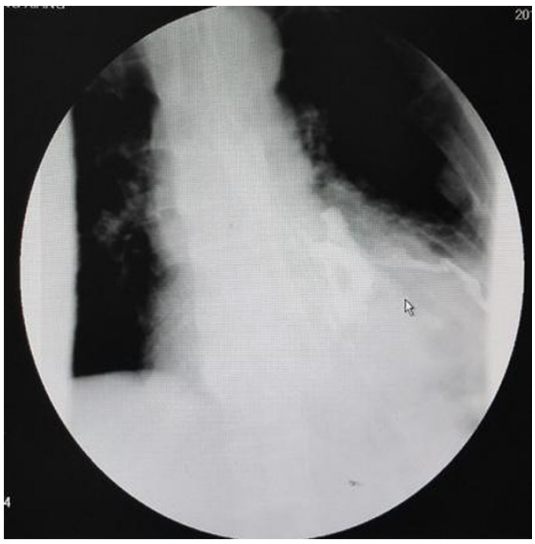

**Figure 3.** Stage III thoracic-gastric fistula: Replacement of the tube with an angiography catheter. The fistula has narrowed.

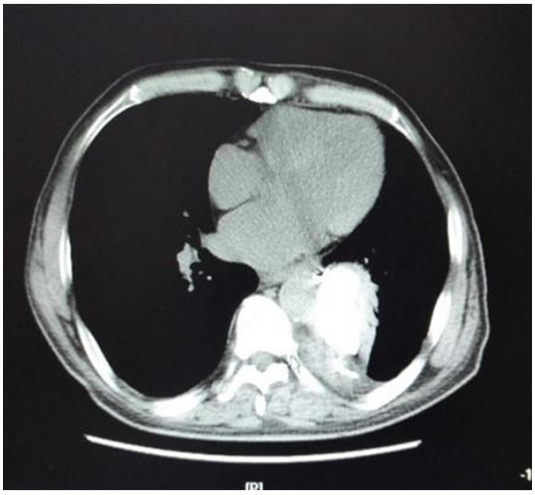

**Figure 4.** After extubation, imaged using oral meglumine diatrizoate and an intrathoracic computed tomographic scan, fistula remnants are in the thoracic-gastric area. Most of the rest closed quickly.

*Stage II clinical features (week 3 or 4):* Normalized temperature with controlled infection; pneumothorax reduction and stability, as indicated by CT; bowel sound recovery; and an unhealed fistula orifice. The aim was to reduce the residual cavity, cultivate the fistula opening, and promote atelectasis.

*Stage III (week 7 or 8) clinical features:* Fistula formation, stable intrathoracic condition, and extensive intrathoracic adhesion. The aim was to narrow, block, and close the fistula.

Early detection and diagnosis of the fistula is key to improving the efficiency of treatment. Early identification and drainage could help avoid severe intrathoracic infection, quickly promote lung expansion, and accelerate healing.

Though intrathoracic washing is necessary to reduce the risk of infection, long-term flushing may delay the leak closure, which may lead to pleural adhesions and fistula formation. For these reasons, appropriate staging and flushing is necessary.

Nose fistula tube drainage (NFTD) consists of pulling the tube into the fistula lumen to achieve continuous pressure suction or flushing. From our perspective, NFTD is not recommended when the size of the fistula orifice is not clear, in case it expands the fistula orifice and slows healing. When treating with NFTD, a drainage tube or mediastinal drainage tube should be combined (fistula estuary drainage) to ensure that the drainage is not blocked.

*Cultivation and plugging of the fistula*

This fistulation method was designed according to the characteristics of orientation drainage and impenetrability. Drainage is directed at the surface after the formation of fistula. Due to the thick fistula tube wall, the infection will not spread in the chest--even if drainage is poor.

The specific method is as follows: During open drainage, an adhesion is identified in the chest, which is one of the reasons for cultivating fistula. We replace the drainage tube (Fred Foley catheter), whose front end was near the fistula or in the esophageal lumen. Then we replace the tube with a finer drainage tube (Foley catheter) to make the fistula even narrower, and then change to an infant catheter (6 to 10, French). In the end, the fistula was very narrow. When there is no sign of infection (eg, fever), the urethral catheter was removed. Granulation tissue quickly closed the fistula after extraction (**Figures 1**-**4**). Compared with biogum, the advantage of this method is that failed or poor drainage does not lead to the difficulty of further processing.

*Nutrition*

In the successful treatment of digestive tract fistula, nutrition status is key. Neither enteral nutrition nor total parenteral nutrition is perfect. Our experience is that enteral nutrition should be given priority over parenteral nutrition. Generally speaking, eating can be considered when the pleural adhesion is formed and bowel sounds are recovered. As long as a thick-walled fistula forms, even if food still leaks from the fistula, it will not cause intrathoracic infection. Attention should be paid to the influence of body position to reduce the leakage of food as much as possible.

## Conclusion

In brief, anastomotic fistula and thoracic gastric fistula cannot be treated blindly. The situation should be analyzed carefully to choose personalized treatment according to the patient's condition. We treat in stages. The key to treatment is correct staging, periodic treatment, adequate drainage, a stable intrathoracic condition, and fistula cultivation. We believe that this therapy is a very effective method of treating intrathoracic anastomotic fistula and thoracic-gastric fistula, but it is important to select the indications and treat each patient individually.

## Disclosure of conflict of interest

None.

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