

Instrumental Perforation of the Esophagus A Case Report and Review of Literature

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ABSTRACT : Thanks to the improvement of the types of the endoscope and the progress of its techniques, the incidence of esophageal perforation has been decreasing recently. It should be pointed out, however, that esophageal perforation is a very serious iatrogenic disease requiring an early diagnosis and an adequate drainage in order to save the lives of patients.

A woman at the age of 68 received gastrofiberscopic examination under suspicion of gastric ulcer, but immediately after the inspection, the patient had severe epigastric pain and dyspnea, and in five hours subcutaneous pneumatosis appeared on her neck.

Chest X-ray pictures revealed mediastinal pneumatosis in high degree and pneumothorax on the left, and blood gas analysis showed the decrease in PO₂ and the rise in PCO₂. Since the patient fell into the state of shock, esophagography and esophagoscopy were not performed, but operation was given immediately. Hematoma was found at a site immediately above the diaphragm and on the left posterior wall, and abscess was formed in the mediastinum.

We did not suture the injured region, but drainage of the mediastinum and the left thoracic cavity was given. After the operation, tracheostomy was performed, and her respiration was managed with a ventilator, simultaneously placing the nasogastric tube within the stomach to reduce the pressure inside it. In 15 days after operation, food intake was resumed, and in 46 days the patient was discharged in good health.

Thus, it is important for esophageal perforation to give drainage as early as possible at a most appropriate position, which will enable us to save the patient in dyspnea and shock in esophageal perforation.

INTRODUCTION

Due to the improvement and spread of the fibroscope, esophageal perforation involved with the insertion of an endoscope has been decreasing. On the other hand, however, the incidence of esophageal perforation as a complication with the endoscopic treatment has rather been increasing.

Essentially, esophageal perforation is a disease following a serious course requiring early diagnosis and proper treatment after onset, and only then the life of the patient can be saved. In this paper, one case of esophageal perforation is presented, and the diagnosis and therapy for this disease is discussed, quoting from the literature.

CASE REPORT

A 68-year-old woman was admitted to a certain clinic with a suspicion of gastric ulcer. The patient underwent gastrofiberscopy with air insufflation, and on that occasion no abnormality was found on the esophageal mucosa. Immediately after performing endoscopy, epigastric pain and dyspnea appeared in her, and it was found that this pain was so severe that the injection of an analgesic was unable to abate it. Although the ECG did not reveal myocardial infarction, chest X-ray films showed pneumothorax and mediastinal air. She was then promptly referred to our Surgical Division of the University Hospital of Oita (in about five hours after onset).

Findings at admission: Her height was 150 cm, weight 36 kg, and she had subcutaneous emphysema on the neck, and cold sensation on her limbs was very remarkable. Her chief complaints was epigastric pain and dyspnea. Her body temperature was 36.6°C, pulse 138/min, blood pressure 96/60mmHg, respiration 30/min. Her respirating sound was weaker on the left side, and murmurs due to subcutaneous pneumatosis were audible. Her upper abdomen was swelling slightly, and a mild tenderness was noted, but there was no muscular defense.

Laboratory data: RBC 504×10^4 , Hb 12.1g/dl, Ht 42.6%, PLT 23.6×10^4 , WBC 11.2×10^3 ,

PO₂ 64.3mmHg, PCO₂ 64.2mmHg, pH 7.25, and BE 0.5.

Chest X-ray pictures revealed mediastinal air in high degree, pneumothorax, subcutaneous emphysema on the neck, and upholding of the left diaphragm due to the extension of the stomach, while in the right lung, emphysema in high degree was noted (Fig. 1,2).



Fig. 1. Chest X-ray film on admission, showing a characteristic picture of pneumothorax and mediastinal emphysema in high-degree.



Fig. 2. Chest X-ray film on admission, showing a remarkable subcutaneous emphysema on the neck besides pneumothorax and mediastinal emphysema.

Judging from her previous history as well as the above findings, esophageal perforation was highly suspected. However, due to her poor systemic conditions, esophagography and endoscopic examinations were not performed, and in about 12 hours, emergency operation was carried out.

With the left postero-lateral approach, the extrapleural space was peeled off to the esophagus, and abscess was found between the esophagus and aorta just above the diaphragm. On the posterior wall 2cm toward the mouth from the attached site of the diaphragm to the esophagus, hematoma was noted, but the perforated wound was not so clear. The operation was finished after constructing a drain on the posterior mediastinum and a drain in the left thoracic cavity.

With a view to facilitating respiration care after operation, tracheostomy was performed, and for two days after operation, respiration was controlled with a ventilator (Fig. 3).

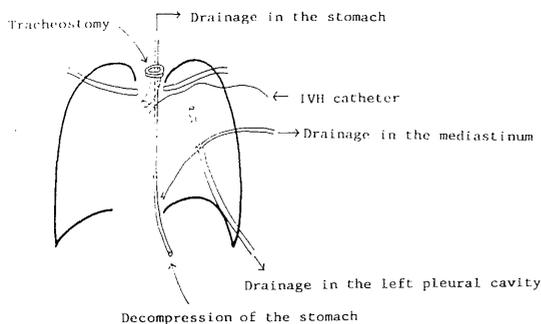


Fig. 3. Schematic picture of the drainage procedure for esophageal perforation.

Other treatments included administration of antibiotics and intravenous hyperalimentation (IVH), and decompression within the stomach with the nasogastric tube was performed.

Prognosis after operation was satisfactory, and in 15 days after operation the patient was able to drink water, and she was discharged from hospital on the 46th days after admission.

DISCUSSION

A pathological state called esophageal perforation or rupture is classified from various aspects, roughly into three groups as follows: a) iatrogenic perforation, b) non-iatrogenic perforation, and c) spontaneous rupture. The incidence of esophageal perforation due to iatrogenic causes occupies the majority of 55-75%,¹⁾²⁾³⁾ among which those caused by endoscopy constituted 44.6%.¹⁾ According to the report on the results of the 1974 American Society for gastrointestinal endoscopy survey, its incidence due to endoscopy was 0.01%,⁴⁾ whereas the statistics in Japan (1975) of NAMIKI due to the fiberscope was 0.03%. It should be pointed out, however, that it is quite natural that there must be differences due to the types of the endoscope, and ability of technicians who handled it, as well as the occasions where endoscopy alone was used for diagnosis or where endoscopic was also given.

Instrumental perforation of the esophagus occurs often at a physiologically stenotic site of the esophagus, among which its first stenotic site is a place where the esophageal posterior wall is easily compressed and crushed between the equipment and the cervical vertebra for the reason of anatomical specificity, and therefore it is a most dangerous site for the insertion of the equipment. According to PALMER *et al.*⁵⁾, esophageal perforation occurred mostly at the following sites: 63.7% at the hypolarynx and cervical esophagus, and 26.7% at the lower esophagus, while NESBITT *et al.*¹⁾ reported it to be 15-20% at the cervical and 80-84% at the intrathoracic esophagus.

Subsequent to the physiologically stenotic site, esophageal perforation occurred often at the esophageal diverticulum and carcinoma, and immediately above a morbidly stenotic site of the esophagus.

On the other hand, WYCHULIS⁶⁾ stated that the following were favorable conditions for the perforation at the hypolarynx and cervical esophagus: 1) obesity and a bull-neck physique, 2) high age and stenosis of the cervical vertebra, 3) deformity of the cervical vertebra, and 4) pharyngoesophageal diverticulum (Zenker's

diverticulum). Symptoms and Diagnosis : Although the symptoms of esophageal perforation vary according to its site, size, direction and the time after it occurred, almost common symptoms are pain, subcutaneous emphysema and fever. In particular, the characteristics of the pain in cervical esophageal perforation include anterior cervical pain, laryngeal pain, deglutitive pain, and tenderness at the jugular fossa, and the sternomastoid muscle.^{6,7)} When such symptoms as redness, swelling and subcutaneous emphysema at the neck, other than the whose characteristic pains, are noted, these could be the criteria for the diagnosis of cervical esophageal perforation. In the cases of lower intrathoracic esophageal perforation, such symptoms as chest pain, mediastinal emphysema, subcutaneous emphysema, fever, and dyspnea are noted, and the patient sometimes falls into shock.

When intraabdominal esophageal perforation takes place, symptoms close to those occurring in the cases of gastric perforation appear.

The patient presented in this paper had lower intrathoracic esophageal perforation, showing the symptoms of epigastric pain, chest pain, subcutaneous emphysema and dyspnea, and falling into the state of shock.

When these symptoms appear after inserting the endoscope or some other instruments into the esophagus, we should first suspect the patient to have esophageal perforation, and differential diagnosis should be given. As for the physical signs, patients ordinarily prefer the sitting position or the semi-sitting position, rather than the lying position, and failures of respiration and circulation can be observed, and sometimes subcutaneous emphysema at the neck is noted. In a case where mediastinal emphysema is found, the so-called Hamman's sign is sometimes audible.⁸⁾

The authors are of the opinion that X-ray simple photography of the neck, chest and abdomen, must always be performed, and we can find subcutaneous emphysema, mediastinal emphysema, dilatation of the mediastinal shadows, pneumothorax and hydrothorax can be recognized. In a case where perforation extent to the intraabdominal esophagus, the picture of free air is visible under the diaphragm.

In this patient, such symptoms as subcutaneous emphysema at the neck, mediastinal emphysema and left pneumothorax were recognized. In a case where perforation was found on the left wall of the lower intrathoracic esophagus, the so-called Naclerio's V-sign⁹⁾ was sometimes noted at the initial stage when mediastinal emphysema was limited.

At the prone position, supine position and at lateral decubitus, esophagography was taken, using a watersoluble contrast medium. It is recommendable on these occasions to insert a slender tube into the stomach, and infuse the medium into it, while drawing out the tube and take the photo of the esophagus.¹⁰⁾

In case leakage of the medium outside the esophagus is noted, the diagnosis of esophageal perforation can be confirmed, and the site, direction, and severity of perforation can be clarified. However, the size of perforation usually looks smaller than its real size.²⁾ It must be pointed out that in a case of perforation, there is a case of false negative where the leakage of the medium is not recognizable.^{1,11)} Particularly in a case of intracervical esophageal perforation, the incidence of false negative is more than those at other sites. In a case of false negative in esophagography using gastrogratin, esophageal perforation can be diagnosed by demonstrating gastrogratin in the urine after esophagography.¹²⁾

In a case where esophageal perforation is suspected but no perforation is confirmed in esophagography, it is worthwhile to observe the site endoscopically by using the esophagofiberscope.⁸⁾ With this procedure, the exact position and size of the perforation can be confirmed, and simultaneously coexisting lesions of the esophagus with this trouble can be confirmed.

Although in a case of lower esophagus perforation, the danger by the use of an endoscope is almost negligible, it needs caution that there exists a danger in a case of cervical esophageal perforation, and in a case where edema is so remarkable on the esophageal mucosa that perforated wounds are aggravated, so that new mucosal tears are created by insertion of instrument.

In a case where retention of pleural effusion

was found with X-ray inspection, thoracic cavity puncture should always be performed. In case the fluid obtained by puncture contains bile juice, the diagnosis can be confirmed. Another method for confirmation is to infuse methylene blue into the esophagus, and confirm if it leaks out into the thoracic cavity or not.

Since patients with esophageal perforation sometimes show such symptoms as dyspnea or shock, early after perforation, it is necessary for surgeons to confirm their previous histories, especially of instrumentation, to grasp their systemic conditions accurately, to control their respiration and circulation, and to trans-thoracic drainage for the cases where pneumothorax or hydrothorax is observed. It is useless only to give oxygen inhalation or transfusion liquid. Following this, food and drinks must be prohibited, alimentary control with IVH must be prohibited, alimentary control with IVH must be continued, and intravenous administration of a broad-spectrum antibiotics must be given. Furthermore, complications with such diseases as diabetes mellitus must be checked and controlled.

The therapy for the lesion is roughly classified into conservative therapy and surgical therapy. In either case, pressure within the stomach should be reduced, and regurgitation into the esophagus should be prevented.

In a case of cervical esophageal perforation, skin incision is to be given along the anterior border of the sternomastoid muscle, reaching the retroesophageal space to give the drainage. In a case where inflammation extends the upper mediastinum, a drain is to be inserted into the upper mediastinum along the esophagus.¹³⁾ Thus, with these treatments, many patients are cured.

In a case of esophageal perforation like this, thoracotomy should be performed, so far as the systemic condition of the patient allows it, and a drainage should be given to the proper position of the thoracic cavity and mediastinum. The safe limit of direct closure of the perforating wound is considered to be in 24 hours^{14,15)} after perforation. When the perforating wound is so small like this case, drainage alone may cure the disease. In some other cases,

where direct closure is difficult to perform, debridement of the border of the wound should be made first, and then cover the wound by the diaphragm patch,¹⁶⁾ pleura patch,¹⁷⁾ or fundic patch of the stomach,¹⁸⁾ and suture it finally. For the reduction of the pressure within the stomach, construction of gastrostomy with tubes, instead of the use of the nasogastric tube, will produce more effect.

Other than the above, drainage of the esophagus with the T-tube is worthwhile to try.¹⁹⁾ In a case where the perforating wound is large, esophagectomy and intrathoracic esophagogastrostomy,^{20,21)} or blunt dissection of the esophagus,²²⁾ is sometimes performed.

In this paper, a report of a clinical case of instrumental perforation in a 68-year-old woman is presented, and the method for diagnosis and treatment of her case is discussed, quoting from the literature. It is important for the treatment of esophageal perforation to give drainage as early as possible at an accurate site.

REFERENCES

- 1) NESBITT, J.C. and SAWYERS, J.L. : Surgical management of esophageal perforation. *The American Surgeon*, **53** : 183, 1987.
- 2) FOSTER, J.H., JOLLY, P.C., SAWYERS, J.L. : Esophageal perforation: Diagnosis and treatment. *Ann. Surg.* **161** : 701, 1965.
- 3) POSTLETHWAITE R. W. : Surgery of the esophagus. Appleton-Century-Crofts, New York, 1979.
- 4) SILVIS, S.E., NEVEL, O., ROGERS, G. *et al.* : Endoscopic complications: Results of the 1974 American society for gastrointestinal endoscopy surgery. *J.A.M.A.*, **235** : 928, 1976.
- 5) PALMER, E.D. and WURTS, C.W. : Survey of gastroscopic and esophagoscopic accidents. *J.A.M.A.*, **164** : 2012, 1957.
- 6) ENDO, M., YOSHIDA, M., HYASHI, T. : Injuries of the esophagus by endoscopic examination. *Geka*. **39** : 1203, 1977. (in Japanese)
- 7) KAKEGAWA, T. : Pathological physiology and treatment of esophageal perforation. *Geka*, **36** : 30, 1974. (in Japanese)
- 8) SHACKELFORD, R.T. : Surgery of the alimentary tract. I. Esophagus. W.B. Saunders Company, Philadelphia, London, Toronto, 1987.
- 9) NACLERIO, E.A. : The " V sign" in the diagnosis of spontaneous rupture of the esophagus.-

- An early Roentgen clue-. *Am. J. Surg.*, **93** : 291, 1957.
- 10) KERR, I.M. : A method of demonstrating the site of perforation of the esophagus. *Brit. J. Radiol.* **35** : 255, 1962.
 - 11) BLADERGROEN, M.R., LOWE, J.E. and POSTLETH WAIT, R.W. : Diagnosis and recommended management of esophageal perforation and rupture. *Ann. Thorac. Surg.*, **42** : 235, 1986.
 - 12) STEPHENSON, H.E. : Perforation of the esophagus ; A challenge to early diagnosis. *Am. J. Surg.*, **115** : 648, 1986.
 - 13) HAYASHIDA, N., FUJITA, M., UMI, Y. *et al* : Drainage procedure into the mediastinum from the cervical region for perforation of the intrathoracic esophagus. *Surgical Diagnosis & Treatment*, **20** : 199, 1978. (in Japanese)
 - 14) ANDERSON, R.L. : Spontaneous rupture of the esophagus. *Am. J. Surg.*, **93** : 282, 1957.
 - 15) MORI, M., NODA, S., SIKANO, Y. *et al* : A case of idiopathic esophageal perforation cured by palliative treatment. *Journal of Clinical Surgery*, **37** : 1709, 1982. (in Japanese)
 - 16) PETROVSKY, B.V. : The use of diaphragm grafts for plastic operations in thoracic surgery. *J. Thorac. Cardiovasc. Surg.*, **41** : 348-355, 1961.
 - 17) GRILLO, H.C. and WILKINS, E.W. : Esophageal repair following late diagnosis of intrathoracic perforation. *Ann. Thorac. Surg.*, **20** : 387, 1975.
 - 18) THAL, A.P. and HATAFUKU, T. : Improved operation for esophageal rupture. *J.A.M.A.*, **188** : 126, 1964.
 - 19) ABBOTT, O.A., MANSOUR, K.A., LOGAN, W.D. *et al* : Atraumatic so-called " spontaneous " rupture of the esophagus. A review of 47 personal cases with comments on a new method of surgical therapy. *J. Thorac. Cardiovasc. Surg.*, **59** : 67, 1970.
 - 20) ISHIGAMI, K., YOSHIDA, Y., NAGAMINE, S. *et al* : A case report of spontaneous rupture of the esophagus. *Operation*, **13** : 399, 1969. (in Japanese)
 - 21) ORIHATA, H., OTA, Y., BEPPU, T. *et al* : A case of spontaneous rupture of the esophagus. *Journal of Clinical Surgery*, **24** : 901, 1969. (in Japanese)
 - 22) OSAKO, T., TATHUMI, A., OKI, K. *et al* : Three surgically treated cases of spontaneous rupture of the esophagus with references to a new surgical approach-eversion stripping and esophagostomy through the posterior mediastinum. *Journal of Japan Surgical Society*, **85** : 592, 1984. (Summary in English)