Palliation of Malignant Tracheal Stenosis with a Second Implantation of an Expandable Metallic Stent Under Endotracheal Intubation

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(Received June 12, 2012; Accepted March 2, 2013)

A 74-year-old man was admitted with respiratory failure and treated for tracheobronchial stenosis due to metastasis of renal cell carcinoma. It improved after implantation of an expandable metallic stent (EMS). One year later, the metastatic tumor at the near distal side of the EMS increased; eventually serious respiratory failure occurred again. However, the delivery catheter of EMS could not be inserted by the usual procedure because there was a strong tracheobronchial curve. Finally it passed along the inside of the endotracheal intubation tube. The respiratory failure was improved by the second implantation of EMS with the method of stent in stent. EMS is often effective in a case with a strong curve and twist of the trachea/bronchi. It was also considered one way of letting the delivery catheter pass inside the endotracheal intubation tube if the patient's respiratory condition was maintained.

Key words: expandable metallic stent, endotracheal tube, malignant tracheobronchial stenosis, tracheobronchial curve, renal cell carcinoma

INTRODUCTION

There have been many successful and safe treatments of tracheobronchial stenosis caused by primarily and metastatic cancer using stent [1–3]. The implantation technique of an expandable metallic stent (EMS) using not a rigid but a flexible bronchoscope has become common to not only surgeons, but also respiratory physicians [4, 5]. There have also been some reports on the safety in the long term management of EMS [6]. However, some serious risks such as granulation restenosis, breakage of the stents, and hemorrhage at the time of removing the metallic stent from trachea/bronchi have been pointed out in the treatment with EMSs [7]. Therefore, in 2005, the Food and Drug Administration (FDA) in the United States cautioned that metallic stents were prohibited in the treatment of cicatric tracheobronchial stenosis [8]. At present, various kinds of silicon stents are used in mainstream treatment. On the other hand, there are still some cases of tracheobronchial stenosis with strong pressure, twists and curves. It seems that the EMS is still effective in such cases. The presenting case two respiratory failures improved by treatment with twice implantations of EMSs using the method of stent in stent for the serious curve of trachea/bronchi caused by metastatic renal cell carcinoma.

CASE REPORT

A 74-year-old Japanese man was diagnosed as having renal cell carcinoma with recognized multiple lung metastasis and left ilium metastasis at another hospital in February 2006. It was considered impossible to cure the illness completely in spite of treatment with interferon gamma and others. For this reason, palliative-care was required, which was in line with the wishes of the patient and his family members. Although the course was favorable, the patient had respiratory failure and obstruction of the right main bronchus caused by metastasis of renal cell carcinoma (Fig. 1a, b) in 2007. Viewing by bronchoscopy, the elevation of the tumor was accepted from the lower right direction of the trachea (Fig. 1c). EMS was carefully implanted using a flexible bronchoscope under conscious sedation. Bleeding occurred just as the tip contacted the tumor. The tip had been guided to the target area by raising it with a flexible bronchoscope after suppressing the hemorrhage (Fig. 2a, c). An EMS (diameter / length : 20/40 mm. Boston Scientific) without covering was implanted in part of the tracheobronchial stenosis (Fig. 2b, d), then the respiratory failure was improved and he was discharged from our hospital on foot.

Since the first implantation of EMS, the respiratory state was stable for one year except for several mild airway infections. However, the metastatic tumor in the proximal end of the EMS increased gradually (Fig. 3 a & b, arrow). In the meantime, we consulted bronchos-

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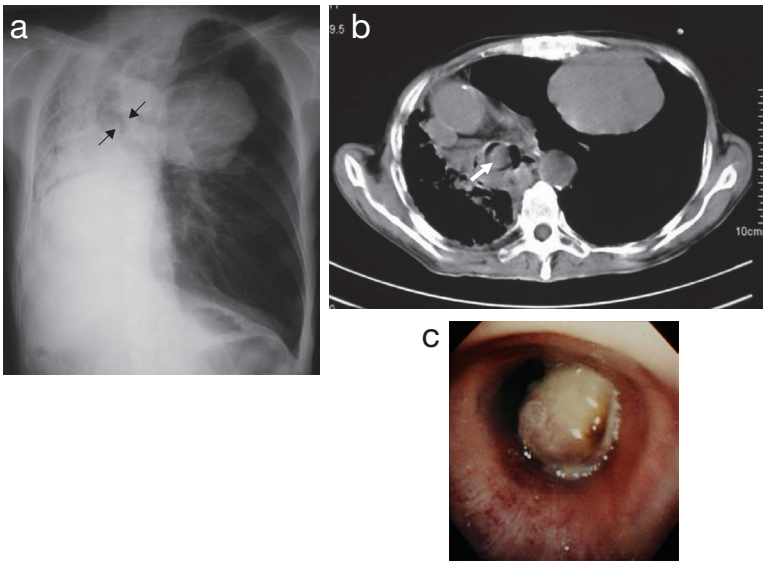

Fig. 1 Findings of a chest radiography (a), a chest computed tomography (b) and a bronchoscopy (c) at hospitalization
The chest radiography (a) shows a solid fist-size tumor in the left upper lung field and right pulmonary atelectasis. In addition, there was evidence of the strong curve and stenosis of the trachea (arrow).
The chest computed tomography (b) showed a solid tumor touching the inner wall of the left thorax and another tumor that invaded the inside of the right main trachea, almost obstructing it (arrow).
The bronchoscopy finding (c) revealed a mass with a glossy and irregular surface, which markedly obstructed the right main trachea.

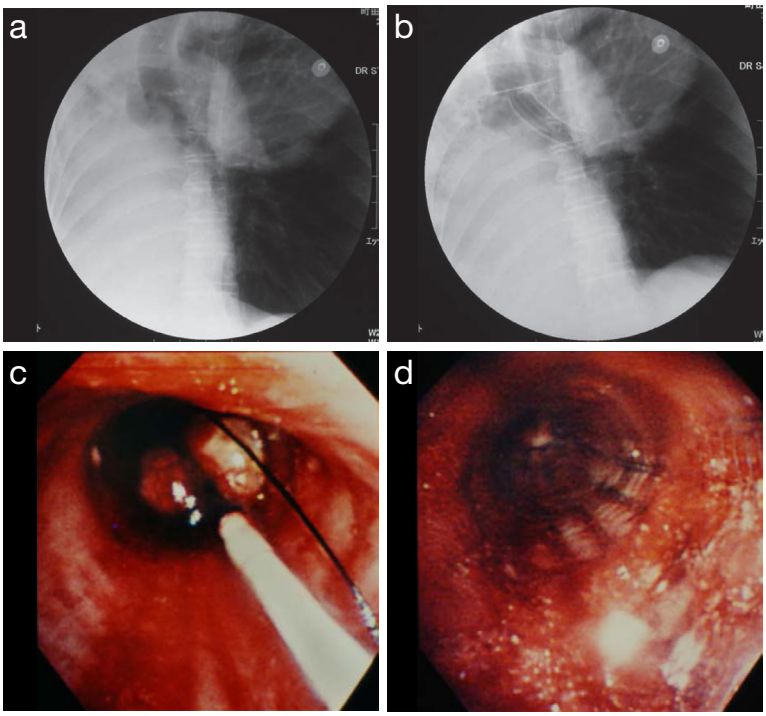

Fig. 2 Findings of chest radiographs (upper side) and bronchoscopy (lower side) at first implantation of expandable metallic stent (EMS)
The EMS was inserted from the lower trachea to the left bronchus (before[a] and after[b]). Although it bled with contact, the delivery catheter of EMS was inserted exceeding the tumor (c). The EMS expanded and covered the tumor portion. Thereby, the respiratory tract was secured and the hemorrhage was also stopped (d)

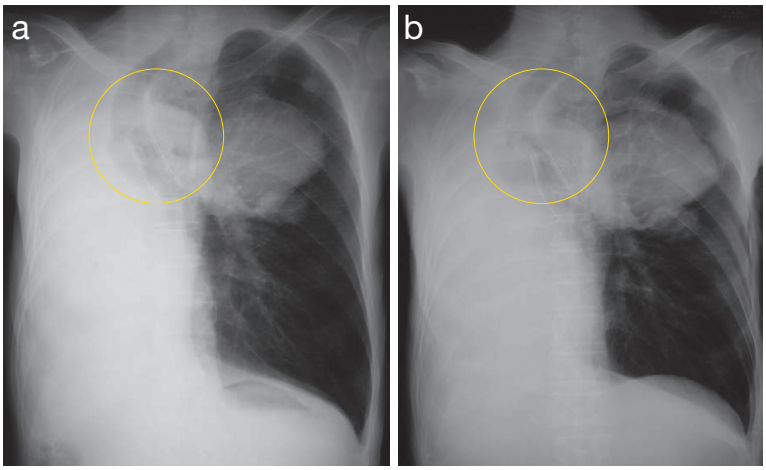

Fig. 3 Findings of chest radiographs during the course after first implantation of EMS
The respiratory tract was still secure six months afterward (a, circle). However, ten months later, the tumor of the proximal end of the EMS grew and it began to obstruct the trachea (b, circle).

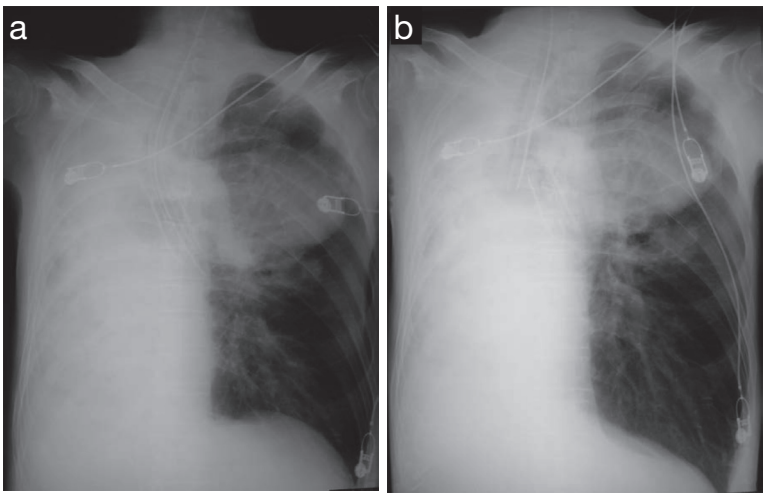

Fig. 4 Findings of chest radiographs under intubation at hospitalization, one year after first implantation of EMS
The intubation tube was inserted exceeding the new tumor to the left bronchus (a). However, the intubation tube fell out from the left bronchus to the trachea as a result of a slight movement of the patient (b).

copy experts of another university hospital with sufficient bronchoscopy equipment for future treatments on this case. The respiratory state was stable at that time. However, there were high risks of both serious bleeding from metastatic tumor and sudden death. So implantation of the stent had to be postponed.

One year later, he was transported to the emergency department in our hospital due to unconsciousness, serious respiratory failure and a large amount of hemoptysis. Mechanical ventilation was given immediately, his respiratory state improved and spontaneous breathing revived. Finally his consciousness level also improved. The chest CT at that time showed that a metastatic tumor that had grown newly in the near distal side of the EMS almost obstructed the main cicatric trachea bronchus. The position of the endotracheal intubation (ETI) tube was very important because the intubation tube had to be inserted exceeding the new tumor to the left bronchus in order to secure the respiratory tract (Fig. 4a). In addition, once the intubation tube fell out from the left bronchus to the trachea due to a slight movement and respiratory failure was induced (Fig. 4b). For this reason, the ETI tube had to be inserted to the left main bronchus. However the length of standard ETI tube was insufficient. The ETI tube had to be extended by approximately 10 cm. The extended ETI tube was made as follows. One third of the ETI tube of 9.5F (internal diameter : ID/ outside diameter: OD = 9.5 mm / 12.7 mm) was connected with the juncture portion of the ETI tube of 7F (ID / OD = 7 mm / 9.3 mm). Thereby, the extended ETI tube stopped slipping with the movement of the patient, and the patient's respiration was secured. The stent needed to be implanted with an emergency bronchoscope in order to secure the airway. However, it seemed that the EMS's delivery catheter did not pass through the tra-

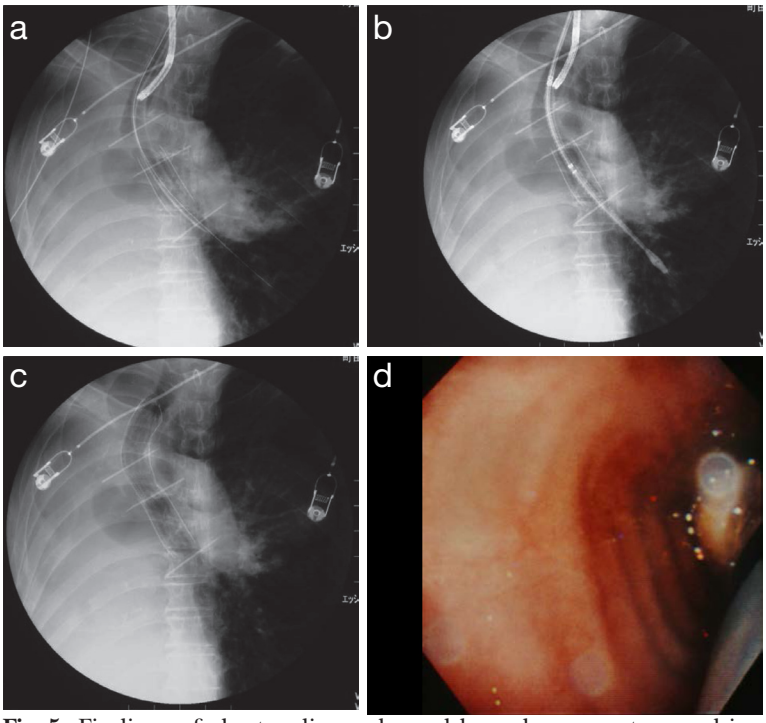

Fig. 5 Findings of chest radiographs and bronchoscopy at second implantation of EMS
A guide wire was passed in the intubation tube (a). The delivery catheter also was passed into the intubation tube using the guide wire (b). The EMS was implanted in the trachea with one centimeter overlap of the previous EMS (c). The new tumor was filling between the intubation tube and trachea. There was no space for guide wire to pass through (d).

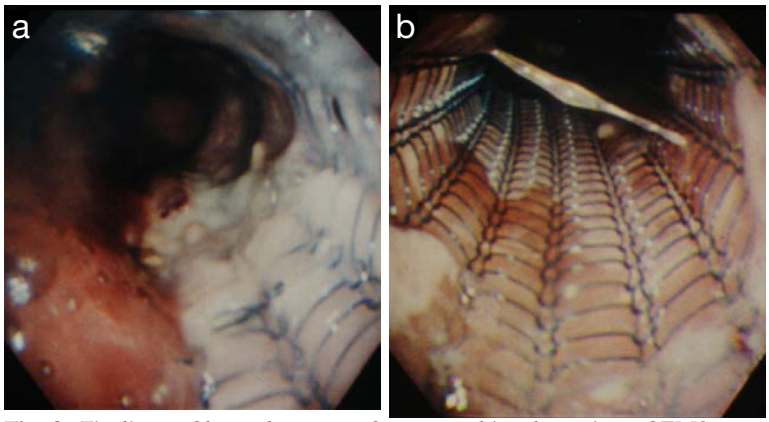

Fig. 6 Findings of bronchoscopy after second implantation of EMS
The EMS expanded (a). The respiratory tract was secured again, covering the tumor portion with overlap of the previous EMS (b).

chea/bronchi because of the curves and twists of the trachea bronchus were more pronounced than in the other cases. Therefore, in order to avoid contacting the EMS's delivery catheter and the metastatic tumor, the guide wire and delivery catheter were inserted for inside of the tracheal tube one by one. Then the delivery catheter was passed most curve part of the trachea/bronchi (Fig. 5a) and reached to the target area. After extracting the tracheal tube (Fig. 5b), the EMS (diameter / length : 20/80 mm. Boston Scientific) without covered was implanted carefully in method of stent in stent (Fig. 5c, Fig. 6 a & b). In the meantime, this procedure was performed under sufficient local anesthesia, and the patient had a spontaneous respiration. We performed that procedure confirming the safety that there was no depression of a patient's oxygen saturation and his vital sign was also stable. The respiratory failure was improved and he discharged from our hospital on foot again.

DISCUSSION

Advances stent materials and progress in techniques of bronchoscopy brought about the interventional pulmonology. Especially in malignant tracheobronchial stenosis with respiratory failure, the implantation of stent is an important treatment improves the performance status [9, 10]. There are currently two kinds of stent material, silicon stent and EMS.

Implantation of a silicone stent requires the aid of a rigid bronchoscope and general anesthesia. From the viewpoint of safety, treatment with a silicon stent is also recommended [11–13]. In implantation of stents under respiratory failure, Noppen M *et al.* [14] and Lo CP *et al.* [15] reported the use of rigid bronchoscopy. In addition, Mroz *et al.* [16] reported the use of flexible bronchoscopy. Any case had a high-risk state, and was not easy. However, since the EMS was able to provide efficient palliation of symptoms even under mechanical ventilation [17, 18], they claimed that EMS was useful for the treatment of severe respiratory distress caused by central airways stenosis, and should be performed [16, 18]. As for their case and this case, the patient's security needed to be ensured. At least, it is important to maintain both the patient's oxygen saturation and vital signs stable. Although there was central airway narrowing in this case, the function of the left lung was sufficient. Therefore, since we performed airway management by endotracheal intubation, we were able to maintain both the oxygen saturation and vital signs of this case. On the other hand, it seemed that using a rigid bronchoscope was difficult in a case with pronounced twists and curves of the trachea bronchus, and implantation of a silicon stent was impossible. Therefore, EMS was chosen in this case. However, the EMS's delivery catheter could not reach the target area, which was the most stenotic part because the guide wire was too soft to deliver the EMS's through into the trachea/bronchi. The tip of EMS's delivery catheter was raised by a flexible bronchoscope and reached the target area at the time of the first implantation. At the time of the treatment of the second respiratory failure, when the stand of a tracheal tube shifts slightly, the respiratory failure became severe (Fig4 a & b). For this reason, an endotracheal tube that was extended by about 10 cm was created. It was inserted exceeding the tumor region using the flexible bronchoscope. Lin and coworkers [19] inserted a flexible bronchoscope through a mouth guard into the space between the tracheal wall and the endotracheal tube. The technique involved inserting a guide wire via a flexible bronchoscope to the lesion site. The guide wire passed along the outside of the endotracheal tube. The delivery catheter was advanced over the guide wire to deploy the stent. However, especially at the time of second implantation of EMS, a bronchoscope could not be inserted into the space between the tracheal wall and the endotracheal tube (Fig. 5d) because in this case, the trachea/bronchi had pronounced twists and curves, so it was difficult to insert a rigid bronchoscope; therefore a silicon stent could not be used. In addition, even though EMS was used, there was insufficient space to deliver the catheter passing outside the endotracheal tube. The catheter could not be inserted using the guide wire in the tracheobronchial transformation. Accordingly, the delivery catheter intercalation passing into the endotracheal tube was considered to be useful to avoid touching the tumor and through into the curves and twists of the trachea/bronchi. However, care must be taken in some cases when both the delivery catheter and the flexible bronchoscope cannot pass into a small endotracheal tube. In this case, an ETI tube with an inner diameter of more than 7 mm should be chosen. If sufficient oxygenation is obtained for airway managements such as by endotracheal intubation, the EMS is often effective in such cases with pronounced curves and twists of the trachea bronchus and a method by which the delivery catheter is passed inside the endotracheal intubation tube is required.

The authors state that they have no conflict of interest (COI).

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