

Post-intubation tracheal rupture. A report on ten cases¹

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Abstract

Objective: We wanted to evaluate the role of surgical and conservative therapy in the treatment of post-intubation tracheal rupture. **Methods:** A retrospective study was performed on 10 consecutive patients (9 women and 1 man) treated over a 7-year period. **Results:** A tracheal rupture following double-lumen intubation was recognized and repaired at the time of lobectomy for lung cancer. Five patients with rents ranging from 2.5 cm to 5 cm underwent primary repair through a cervical collar incision ($n = 3$) or right posterolateral thoracotomy ($n = 2$). Three patients had small tears (about 1 cm in length) and were treated conservatively. Tracheostomy was performed in one patient with a 1.5-cm long laceration and extensive subcutaneous emphysema. Results were uniformly good. **Conclusions:** Early surgical repair is the preferred treatment for most patients with post-intubation tracheal ruptures. Conservative treatment may be a viable alternative for patients with small rents, in the absence of gross air leak, or for those judged unsuitable for surgery. The role of tracheostomy is limited by its potential for late sequelae. © 1997 Elsevier Science B.V.

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1. Introduction

Tracheal rupture (TR) is one of the most feared immediate complications of intubation. Respiratory insufficiency and even death may result from it. Both conservative and surgical therapy have been advocated, but the condition is uncommon and data concerning results are sparse [2,4,5,8,11].

To evaluate the role of available treatment options, we retrospectively reviewed our experience in the management of 10 consecutive patients with TR following intubation.

2. Material and methods

The medical records of all patients treated at our institution for TR as a complication of intubation during the period from June 1988 to June 1995 were reviewed. Data were collected with regard to demographics, extent and location of the injury, initial tracheal intubation and anesthetic course, mode of presentation, treatment modalities, immediate and long-term results.

3. Patient population

Over a period of 7 years, from June 1988 to June 1995, 10 consecutive patients with the diagnosis of post-intubation TR were treated in our Thoracic Surgery Division.

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Eight patients were referred to us for management of their post-intubation TRs, while two had undergone their original tracheal intubations at our Division. During the period of this case review, we used a total of 1570 double-lumen tubes. Thus, the incidence of TR following double-lumen intubation was 0.12%.

The site of injury was in the posterior membranous part of the trachea, at cervical (6 cases) or thoracic (4 cases) level. The lesions were all longitudinal, ranging in size from 1 cm (3 cases) to 5 cm (4 cases).

There were 9 women and 1 man, and their ages ranged from 23 to 72 years (mean 50 years).

None of the patients had evidence of pre-existing tracheal pathology or malformation, and six had received anesthesia(s) uneventfully in the past.

The original tracheal intubation was performed with polyvinylchloride (PVC) tubes, single-lumen in eight patients and double-lumen in two (one Carlens tube and one White tube, respectively). Only in these patients was a stylet used. Usual anesthetic management consisted of a halogenated agent and nitrous oxide supplemented by intravenous fentanyl as required. Nitrous oxide was not used in the two patients who underwent thoracotomy. The anesthetic teams reported no difficulty with any aspect of the intubation or the intraoperative course. Surgical procedures carried out varied greatly, from diagnostic celioscopy and appendectomy to nephrectomy and pneumonectomy.

In six patients the clinical presentation was marked by the appearance of subcutaneous emphysema in the neck and upper thorax shortly after recovery from anesthesia. One patient developed a tension pneumothorax which was the cause of acute respiratory distress. Another had minimal haemoptysis on awakening: a chest film was normal, and she was discharged the same evening only to be readmitted on the fifth postoperative day because of the acute onset of chest pain and subcutaneous emphysema. In these patients, the definite diagnosis of post-intubation TR was made bronchoscopically, on admission in our Division, while in the two remaining patients, operated on for lung cancer, the recognition of the tracheal injury was intraoperative. At the completion of a right lower lobectomy, the surgeon noticed an abnormal mass in the superior mediastinum, which turned out to be the tracheal cuff of the Carlens tube herniating through a 5-cm tracheal laceration. The last patient was undergoing left pneumonectomy: at the end of the procedure, the bronchial stump was tested under water. This showed a tiny air leak, coming from the opposite side of the distal trachea. Bronchoscopy revealed a small mucosal bruise in the distal trachea, but no actual tear. Because no air leak was observed during spontaneous ventilation, fibrin glue was applied in the carinal space and the chest closed, leaving a balanced drain in the pneumonectomy space.

4. Treatment and results

Six patients had tracheal lacerations ranging from 2.5 to 5 cm and underwent surgical repair. Under bronchoscopic guidance, a short-cuffed, extra-long endotracheal tube was cautiously passed into the distal trachea or into the left main bronchus, according to the location of the rupture. Three lesions of the upper half of the trachea were approached through a cervical collar incision, while three patients with rents in the lower half of the trachea underwent a right posterolateral thoracotomy. Tears were closed with interrupted absorbable sutures. The suture line was reinforced with a pleural flap in the thorax. Postoperatively, all of the patients did well and had a satisfactory bronchoscopy before discharge from the hospital.

An overweight woman (92 kg, 1.60 m in height) with a 1.5-cm long tear of the cervical trachea and extensive subcutaneous emphysema underwent tracheostomy. She had an uncomplicated recovery and was discharged on the fourteenth day with a healing tracheostoma.

Three patients were deliberately treated conservatively with continuous airway humidification, broad-spectrum antibiotics, and chest physiotherapy. Two of them had a small (about 1 cm long) rent of the cervical trachea with moderate subcutaneous emphysema. Both did well under supportive treatment and showed a regular tracheal lumen at bronchoscopy 8 days after injury. The last patient had his distal thoracic trachea injured during left pneumonectomy. On the fifth postoperative day, because of increasing subcutaneous emphysema and dyspnea, a right paratracheal drain was inserted through a suprasternal incision. A small air leak ceased quickly, and the patient was discharged on the fifteenth postoperative day after bronchoscopy confirmed complete healing of the trachea.

All of the patients included in this study have been symptom-free after treatment with follow-up ranging from 13 to 68 months (on average 34.6). Long-term (mean 5 months) endoscopic assessment has always showed a regularly shaped tracheal wall.

5. Discussion

Tracheal disruption following elective intubation is a rare entity, occurring in less than 1% of patients when double-lumen tubes are used. Certainly, its incidence with single-lumen tubes is lower, but a number of cases may be misinterpreted as secondary to the rupture of subpleural blebs or bullae [5,8].

Proposed etiologic factors of this injury relate to the patient, the operator, the endotracheal tube, and the technique of intubation and anesthetic management [4,11].

Women are much more prone than men to the risk of TR following intubation, but this could be due to the use of an oversized tube rather than constitutional reasons.

The operators involved in this series were well-trained anesthesiologists and the intubations were reported as 'easy' and uneventful. A stylet was used with double-lumen tubes, and removed as soon as the tube tip passed the vocal cords.

The initial endoscopic finding of a small mucosal bruise in the distal trachea of the patient who underwent left pneumonectomy can be regarded as a likely example of direct trauma of the tip of the White tube or its carinal hook. In most of the remaining cases, the finding of a clean, sharp-edged longitudinal tear in the posterior membranous part of the trachea, at cervical level (when using a single-lumen tube) or at thoracic level (when using a double-lumen tube), may indicate a cuff-induced rupture [7,12]. Indeed, during surgical procedures cuff pressure was not monitored nor was the cuff filled with a mixture of oxygen and nitrous oxide [3].

Usually, the clinical manifestations of tracheal injury (subcutaneous emphysema, pneumomediastinum, pneumothorax, and respiratory impairment) appear during surgery or in the immediate postoperative period. However, they are not specific and can be present without TR [8]. Besides, radiographic signs (displacement of the endotracheal tube tip to the right with an overdistended balloon) are indirect [10]. Consequently, bronchoscopy is essential to establish a definite diagnosis.

Adequate treatment strategy of a post-intubation TR is dependent on the size and site of the rent, its clinical presentation, and the overall condition of the patient [4,5,11].

When the lesion is discovered during a thoracic surgical procedure, primary repair is usually possible [5,8].

Small tears (about 1 cm in length), in the absence of gross air leak and respiratory embarrassment, can be treated conservatively, with continuous airway humidification, broad-spectrum antibiotics, and chest physiotherapy [1,6].

Lesions larger than 2 cm, in the presence of extensive subcutaneous emphysema and/or respiratory distress, are best treated by early surgical repair if feasible [4,7,9,11]. Close coordination with anesthesia is imperative in order to minimize the risk of further disruption of the airway. Rents in the upper half of the trachea are approached through a cervical collar incision, whereas a high right posterolateral thoracotomy incision provides access to a thoracic TR. In view of the usual thinness of tracheal membranosa in these patients, the

repair is done with an interrupted suture technique, using absorbable synthetic material.

Finally, tracheostomy, which decreases airway pressure and air leakage through the TR, may prove useful in the occasional patient with intermediate lesion and extensive subcutaneous emphysema. However, nasotracheal intubation with the cuff inflated distal to the tear could be equally effective and avoid another lesion to the already injured trachea [7,11,12].

In conclusion, selection of treatment for post-intubation TR must remain individualized. Early surgical repair is the preferred treatment in most patients. Conservative therapy may be a viable alternative for patients with small tracheal rents, in the absence of gross air leak, or for patients with major medical problems that preclude a safe surgical repair.

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