

## Surgery for Traumatic Injury of the Trachea and Bronchus

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Surgery for traumatic disruption of the trachea and the bronchus was evaluated with respect to the surgical outcome in three with tracheal injury and four with bronchial injury. In this series, the results were satisfied except for one who underwent delayed operation. Experience seems to indicate that the primary care to ensure security of air way is of great value in life-saving and guarantee of the outcome including pulmonary function following surgery.

In conclusion, it is emphasized that the fortuitous result and preservation of pulmonary function are mandatory for pertinent treatment with expeditiously precise diagnosis.

### Introduction

In recent year, an increase in traffic accident has brought on catastrophic event. One of the most severe injuries is a traumatic rupture of the trachea and bronchus directly

related to life-saving. The optimal cares of the first aid necessitate to persist life-saving and to ensure better outcome. As far as injury to intrathoracic trachea and bronchus is severe, early precise diagnosis and emergency operation are inevitable for life-saving.

The aim of this study is to clarify the validity of surgical management of traumatic injuries to the trachea and bronchus and to know how to effectively treat on the basis of a result of our clinical experience.

### Patients

During the past ten years from January, 1983 to December, 1992, at the First Department of Surgery, Nagasaki University School of Medicine, we experienced three patients with tracheal injuries and four with bronchial one (Table 1, 2). The ages of patients with tracheal injuries ranged from 19

**Table 1.** Patient with tracheal disruption

age	symptom	chest X-P	endoscopy	operation	outcome
26	bloody sputum subcutaneous emphysema	first rib fracture	hematoma	direct suture	fair
24	bloody sputum subcutaneous emphysema	widened mediastinum	not visible with blood	direct suture	fair
19	aphone	mediastinal emphysema		direct suture	fair recurrent nerve paralysis

**Table 2.** Patients with bronchial disruption

age	symptom	chest X-P	injured site	op. procedure	outcome
15	dyspnea bloody sputum	r-pneumothorax	r-main bronchus r-upper lobe laceration	bronchoplasty upper lobectomy	fair
5	dyspnea	bilateral pneumothorax	r-upper and middle bronchus	bronchoplasty	fair
58	bloody sputum	r-pneumothorax	r-main bronchus mediastinal emphysema	bronchoplasty	fair
49	dyspnea bloody sputum	l-pneumothorax	l-main bronchus	l-pneumonectomy	fair

to 26, showing younger ages. On the other hand, the ages of patients with bronchial injuries distributed from 6 to 58 of age with a wide range. In patients with trauma to the trachea, it was indicated that injured sites in this series were limited to the neck and injuries were directly caused by a high power-force. In contrast, injuries to the bronchus was due to blunt chest trauma by forceful power. The initial symptoms were similar, bloody sputum and dyspnea in both injuries to the trachea and the bronchus. The findings of chest x-ray were characteristic of subcutaneous emphysema and widened mediastinal shadow in case of tracheal injury and unilateral or bilateral pneumothorax in bronchial injury. In those patients, endoscopic examination failed to provide adequate information because of restriction of visual field by bloody sputum and time limitation of endoscopy for dyspnea.

Surgical treatments were mandated in all patients. In tracheal injury, surgery was indicated as soon as a diagnosis was made. On the other hand, in bronchial injury, the time applying surgery varied from 17 hours to 41 days. The surgical procedure used was direct suturing in all of tracheal injury. In contrast, in bronchial injury, the right main bronchus was injured in three and the left main bronchus was affected in the other one. The main bronchi are usual fortuitous site of injury. The bronchoplastic procedure was indicated in three in whom the right main bronchus was damaged and left pneumonectomy was carried out in one whose diagnosis was delayed to result in pulmonary suppuration on day 41 after trauma. The surgical outcome was satisfied and returned to life in society. Preservation of pulmonary function is mandatory for and confined to prompt diagnosis and surgical management.

## Discussion

The majority of tracheobronchial laceration are caused by penetrating traumas. As reported by Kelly *et al* (1), only six patients were caused by blunt chest trauma out of 106 experienced during the 20 year duration. It is generally accepted that an increase in traffic accidents and plant calamity has been accompanying increasing tracheobronchial injury. However, it remains dubious how many patients with tracheobronchial injury are treated because grave accidents cause deaths directly before precise diagnosis. Ecker et al (2) reported seventy percent of chest trauma patients are death on arrival (DOA). Needless to say, deaths in the majority of the patients are in association with concurrent injury involving great vessels. Even in case without concomitant injury, the mortality rate accounts for approximately 30 percent (3-5).

In this series, the reason for obtaining a good result for patients with tracheal trauma is that the injured trachea confined to the cervical portion. Concern has been raised regrading difficulty in the treatment of injury to intratho-

racic trachea. Life-saving is dependent on how to establish security of air way. Expedient decision is essential as to whether tracheostomy or intubation are preceded. To the best of our knowledge, bronchoscopy is of great help in precise diagnosis. Protrusion and fragmentation of parts of the mucosa and the cartilage are a key finding in recognizing the presence of tracheobronchial injury (6). In some cases, special technique of endoscopy-guided intubation is required for patients with complete rupture of the tracheobronchial tree (7). Patients with laceration of tracheal bifurcation deserve special attention to difficulty in patient management. There is no report on successful treatment for complete rupture of tracheal bifurcation. In contrast, a few reports are available for a guide of successful treatment for patients with laceration of the tracheal wall extending to the bifurcation (4, 8, 9, 10).

The optimal primary care is essential in security of life. Success in delayed operation sometimes has been reported by healing of scar formation at injured sites. Indwelling of stent tube and the use of dilator are the other option of the management at late stage (10, 11).

Bronchial rupture is caused by blunt chest trauma and bilateral main bronchi 2.5cm adjacent to the bifurcation are predominantly injured (3, 12). The mechanism is explained that (1) thorax results in severe deformity to transverse direction by compression of powerful force and then the lungs are laterally drawn exceeding lung elasticity. As a result, the main bronchus cause rupture and laceration at the site 2.5cm near the bifurcation. (2) reflectory closure of glottis provokes increased intratracheal pressure at the time of chest trauma. consequently the main bronchi tends to cause rupture by being sandwiched between the sternum and the thoacic vertebrae. (3) Fixation of the trachea with cricoid cartilage and its bifurcation carry the rupture of the main bronchial wall.

The surgical technique of suturing anastomosis has been refined with improvement of suture material and instrumental development of high frequency jet ventilation (13, 14) to facilitate perioperative respiratory support and also meticulous postoperative cares have been developed in terms of bronchoscopy-guided aspiration to depressed cough reflex caused by denervation (15) and gentle aspiration to prevent mechanical damage to anastomosis by catheter tip.

Great stride in the treatment of traumatic disruption of the tracheobronchial tree has been achieved with advances in diagnostic techniques. In this study, the surgical outcome was satisfied as far as early treatment had been attempted.

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