ORIGINAL ARTICLES

Medical and Surgical Management of Noniatrogenic Traumatic Tracheobronchial Injuries

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OBJECTIVE: To describe the medical and surgical management of noniatrogenic traumatic tracheobronchial injuries.

PATIENTS AND METHODS: From January 1993 to July 2004, 15 cases of traumatic tracheobronchial injury were treated in our department. The diagnosis was established by bronchoscopy and a computed tomography chest scan was performed on all patients. Surgical treatment was selected for patients with unstable vital signs, an open tracheal wound, associated esophageal lesions, progression of subcutaneous or mediastinal emphysema, mediastinitis or suspicious mediastinal secretions on imaging tests, or difficulties with mechanical ventilation due to the traumatic tracheobronchial injury.

RESULTS: The mean (SD) age of the patients was 35.5 (18.9) years and 12 (80%) were male. Of the 15 cases, 13 (86.7%) had penetrating trauma and 2 (13.3%) blunt trauma. The most common location of the injury was in the bronchi (9 cases; 60%), followed by the cervical trachea (4 cases; 26.6%), followed by both the thoracic trachea and bronchi (2 cases; 13.4%). The most common initial symptom was subcutaneous emphysema, which presented in 11 (73.3%) patients. Chest (12 cases; 86.7%) and orthopedic injuries (9 cases; 60%) were the most common associated injuries. Surgery was the treatment of choice in 11 (73.3%) cases and conservative medical treatment in 4 (26.7%). An irreversible brain injury caused the death of 1 patient receiving conservative treatment.

CONCLUSIONS: Tracheobronchial injuries may be treated conservatively if they meet strict selection criteria. Size and location should not be used as selection criteria for surgical treatment.

Key words: *Tracheobronchial injuries. Trauma. Bronchial rupture. Subcutaneous emphysema. Bronchoscopy. Thoracotomy.*

Manejo médico-quirúrgico de las lesiones traqueobronquiales traumáticas no iatrogénicas

OBJETIVO: Describir el manejo médico-quirúrgico de las lesiones traqueobronquiales traumáticas no iatrogénicas.

PACIENTES Y MÉTODO: De enero de 1993 a julio de 2004 se registraron en nuestro servicio 15 casos de lesiones traqueobronquiales traumáticas. En todos los pacientes el diagnóstico se estableció por broncoscopia y a todos se le realizó una tomografía computarizada de tórax. Se eligió tratamiento quirúrgico cuando había inestabilidad vital del paciente, herida traqueal abierta, lesiones esofágicas asociadas, progresión de enfisema subcutáneo o mediastínico, mediastinitis o colecciones mediastínicas sospechosas en pruebas de imagen o dificultades en la ventilación mecánica por la lesión traqueobronquial traumática.

RESULTADOS: La edad media (± desviación estándar) de los pacientes fue de 35,5 ± 18,9 años y 12 (80%) eran varones. Se registraron 13 traumatismos cerrados (86,7%) y 2 abiertos (13,3%). La localización más frecuente de la lesión fue bronquial (9 casos; 60%), seguida de tráquea cervical (4 casos; 26,6%) y tráquea toracicobronquial (2 casos; 13,4%). El síntoma inicial más frecuente fue el enfisema subcutáneo, que presentaron 11 pacientes (73,3%). Las lesiones asociadas más frecuentes fueron torácicas, con 12 casos (86,7%), seguidas de ortopédicas, con 9 (60%). El tratamiento de elección fue quirúrgico en 11 casos (73,3%) y médico conservador en 4 (26,7%). Falleció una paciente tratada de forma conservadora por lesión cerebral irreversible.

CONCLUSIONES: Las lesiones traqueobronquiales pueden tratarse de forma conservadora si cumplen criterios estrictos de selección. El tamaño o la localización no debe ser un criterio para la elección del tratamiento quirúrgico.

Palabras clave: *Lesiones traqueobronquiales. Traumatismo. Rotura bronquial. Enfisema subcutáneo. Broncoscopia. Toracotomía.*

Introduction

The incidence of traumatic tracheobronchial injury has been rising in recent decades, largely because of an increase in traffic accidents and the growing use of general anesthesia with orotracheal intubation in older patients.[1] Most noniatrogenic traumatic injuries are the result of high-energy blunt trauma, such as those caused by traffic accidents and falls. Nevertheless, the incidence of noniatrogenic injuries following intubation and tracheotomy is increasing.[2] Despite improvements in emergency transportation services, more than 30% of patients with a traumatic tracheobronchial injury die before reaching the hospital.[3] The overall incidence of these types of injuries is approximately 1% to 2% of

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high-energy accidents,[4,5] and with only a few cases occurring each year, opportunities to train health care professionals to manage them are scarce.[6,7]

This study describes the surgical and medical approaches to the treatment of noniatrogenic traumatic tracheobronchial injuries and the indications for selecting one or the other.

Patients and Methods

We retrospectively reviewed the medical records of patients diagnosed with a noniatrogenic traumatic tracheobronchial injury at our hospital from January 1993 to July 2004. Iatrogenic traumatic tracheobronchial injuries —most of which have no associated traumatic injuries—were excluded because the prognosis and management of these injuries are very different from those caused by noniatrogenic injury. All patient characteristics of note were recorded: cause, initial symptoms, location of injury, diagnostic tests performed, associated injuries, treatment, length of hospitalization, and follow up. All patients underwent flexible bronchoscopy and a computed tomography chest scan. In most cases, surgical treatment was selected for those patients with associated esophageal lesions, open tracheal wounds, progression of subcutaneous or mediastinal emphysema, mediastinitis or suspicious mediastinal secretions, difficulties with mechanical ventilation or deterioration of vital signs due to sepsis or acute respiratory distress syndrome. The size of the injury was measured by bronchoscopy. None of the following were considered indications for surgery: early diagnosis, a specific lesion size, bronchial involvement, involvement of the cartilaginous tracheal wall, or the need for mechanical ventilation due to some other cause. Treatment for nonsurgical cases included antibiotics and observation without surgery. Early extubation was attempted in all patients, whether treated conservatively or surgically; if this was not feasible, tube insertion was attempted below the level of the injured area when possible. To avoid weakening the sutures in patients with bronchial injuries, mechanical ventilation—when necessary—was performed at the lowest possible pressure at which the patient's vital signs could be kept stable without selective intubation. In the surgical interventions, biodegradable tracheobronchial sutures were used and lung resection was avoided if possible. In all cases, we used interrupted sutures covered by proximate autologous tissue. For esophageal injuries, primary sutures were used in some cases and esophageal exclusion in others, with reconstruction by coloplasty deferred to a later time. Case 13 required a right pneumonectomy and reconstruction of the tracheal carina because of the size of the injury to the main right bronchus and tracheal carina. Clinical and bronchoscopic follow up of all surviving patients was performed at discharge and after 3, 12, and 24 months.

Descriptive statistical analysis was performed with the SPSS 11.0 Statistical Software Package (SPSS; Chicago, IL, USA).

TABLE 1
Characteristics of Patients and Injuries*

Case	Sex/Age, Years	Type of Trauma	Initial Symptom	Location	Size, cm	Treatment	Result
1	M/47	Penetrating Cervical stab wound	SE	Cervical trachea	3	S	Excellent
2	M/55	Penetrating Sports accident	SE	Cervical trachea	1	S	Excellent
3	F/84	Blunt Accidental direct trauma	SE	Cervical trachea	2	Me	Death
4	F/30	Blunt Traffic accident	SE	Bronchi	2	Me	Excellent
5	M/27	Blunt Traffic accident	SE	Thoracic trachea and bronchi	2	Me	Excellent
6	M/35	Blunt Traffic accident	SE	Cervical trachea	2	S	Excellent
7	M/14	Blunt Traffic accident	P	Bronchi	4	S	Excellent
8	M/48	Blunt Traffic accident	SE	Bronchi	2	S	Excellent
9	M/14	Blunt Crush injury	D	Thoracic trachea and bronchi	6	S	Excellent
10	M/26	Blunt Fall	SE	Bronchi	1	S	Excellent
11	M/28	Blunt Crush injury	SE	Bronchi	1	Me	Excellent
12	M/20	Blunt Traffic accident	P	Bronchi	2	S	Excellent
13	M/17	Blunt Traffic accident	P	Bronchi	2	S	Excellent
14	M/23	Blunt Traffic accident	SE	Bronchi	1	S	Excellent
15	F/20	Blunt Traffic accident	SE	Bronchi	1	S	Excellent

*M indicates male; F, female; SE, subcutaneous emphysema; P, pneumothorax; D, dyspnea; S, surgery; Me, medical.