light barbiturate–nitrous oxide anesthesia, topical laryngotracheal administration of lidocaine using a laryngoscope and LTA® kit causes significant increases in ICP, HR, and MAP and does not protect against potentially harmful cardiovascular and intracranial pressure changes induced by endotracheal intubation. Intravenous lidocaine, 1.5 mg/kg, given one minute before intubation, both prevents intracranial hypertension and also limits the intensity and duration of cardiovascular stimulation. These data indicate that the intravenous route is the preferred technique for administering lidocaine prior to endotracheal intubation.

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Obstruction of Anomalous Tracheal Bronchus with Endotracheal Intubation

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Several authors have described clinical symptoms in unanesthetized patients associated with a tracheal bronchus.[1–6] In this paper, we describe a case where an otherwise asymptomatic patient developed a right upper lobe collapse with endotracheal intubation during anesthesia. The diagnosis of an anomalous tracheal bronchus acutely obstructed by the endotracheal tube was made by fiberoptic bronchoscopy.

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Key words: Complications: intubation, endotracheal. Airway: obstruction, anatomy, anomalous tracheal bronchus.

Report of a Case

A 12-year-old male child was scheduled for excision of maxillary and mandibular cystic lesions. He had no history of pneumonia, airway distress, or known congenital anomalies. Preoperative chest roentgenograph was normal. A 6.5-mm nasotracheal tube was inserted into the trachea with direst visualization utilizing the McGill forceps. The endotracheal tube cuff was palpated in the trachea just superior to the sternal notch. Breath sounds were initially decreased over the right upper lobe but appeared to become equal after withdrawal of the endotracheal tube by about 1 cm. Breath sounds were never decreased on the left side, and chest expansion appeared symmetric. Surgery proceeded during 60 per cent N_2O and 1–2 per cent enflurane anesthesia and spontaneous ventilation.

Approximately 15 min after the start of surgery, the patient became cyanotic. Auscultation of the chest revealed absence of right upper lobe breath sounds, and percussion revealed dullness over the area. Further withdrawal of the endotracheal tube with palpation of cuff further above sternal notch failed to resolve the problem. Chest roentgenogram revealed complete collapse of the right upper lobe.

While the trachea was still intubated, fiberoptic bronchoscopy was performed during which time an anomalous tracheal bronchus originating about 1 cm above and anterolateral to the right main bronchus was visualized (figs. 1 and 2). The endotracheal tube was removed.

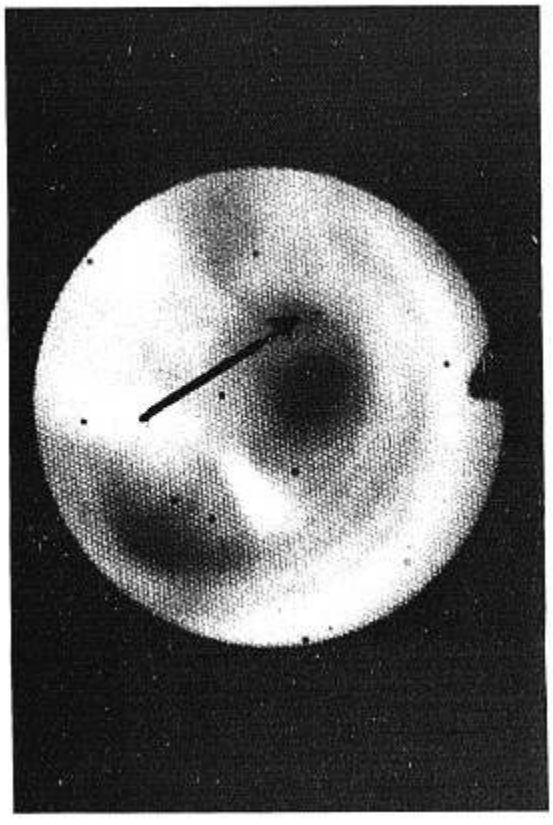

FIG. 1. Bronchoscopic view from high above carina in trachea. Arrow reveals origin of anomalous tracheal bronchus anterolateral to right mainstem bronchus.

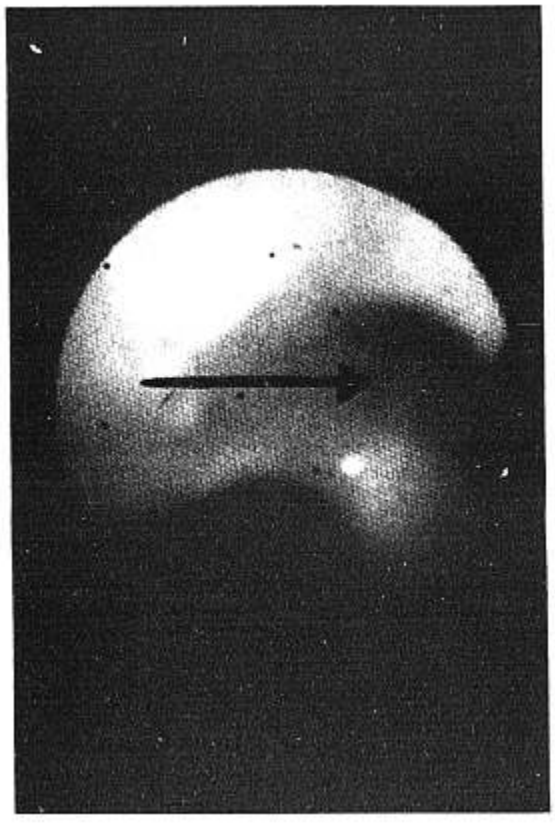

FIG. 2. Bronchoscopic view taken in close proximity to anomalous tracheal bronchus (arrow). The right mainstem bronchus is at lower margin of picture.

The right upper lobe was noted to be reinflating by chest roentgenogram. The patient received chest physiotherapy to encourage reexpansion of the right upper lobe. Twenty-four hours later, the chest roentgenogram showed complete reexpansion of the right upper lobe.

DISCUSSION

The pathophysiology of tracheal bronchi has been discussed elsewhere.[1-8] Infrequent reports in the literature suggest that the anomaly is very rare. However, Atwell[7] found five cases of tracheal bronchi in 1,200 consecutive patients receiving bronchograms. The tracheal bronchi are nearly always found on the right side usually supplying all or part of the right upper lobe. In addition to a single anomalous bronchus, occasionally another bronchus originating from the right main bronchus, or its branches, also supplies the right upper lobe.

The paucity of reported anesthetic complications from this anomaly is possibly due to the fact that the origins of the tracheal bronchi are usually less than 2 cm from the carina.[7] Therefore, they are rarely obstructed by an endotracheal tube cuff except during an endobronchial intubation. In this particular patient, the obstruction of the anomalous tracheal bronchus during the intraoperative period could have been due to inadvertent migration of the nasotracheal tube with surgical manipulation of the head. Also a "ball-valve" obstruction may have occurred during spontaneous ventilation by the tip of the tube lying adjacent to the anomalous bronchi. The chest roentgenogram taken immediately postoperatively after partial withdrawal of the endotracheal tube revealed that the tip of the tube was in close proximity to the right tracheal wall. Prior to this time, when the tube was in a more distal position, a ball-valve obstruction of the anomalous right tracheal bronchus could have occurred. The inability to immediately reinflate the right upper lobe, even after withdrawal of the tube above the anomalous bronchus may have been due to edema formation in the small diameter anomalous bronchus.

The cyanosis that the patient developed could be due to inhibition by enflurane of right upper lobe hypoxic vasoconstriction with significant shunting resulting in the supine patient breathing spontaneously.

This case serves to emphasize that presence of a tracheal bronchus should be considered in the differential diagnosis of decreased right upper lobe breath sounds with endotracheal intubation that persists despite confirmation of cuff position above the sternal notch.

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Laser-induced Endotracheal Tube Fire

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The energy of a high-intensity monochromatic beam of light as produced by a laser is frequently used as a surgical tool. On contact with the tissues, the light energy is converted to heat which is used to resect tissue. If the laser beam strikes a flammable object such as an endotracheal tube (ETT), a fire may result. Such fires have produced either superficial tracheal burns or no significant injury[1,2] In those cases, direct ignition of the endotracheal tube occurred. Indirect ignition of the endotracheal tube can occur when the tube is ignited by burning pieces of tissue that lie next to the tip of the tube.[3,4] In our case described below, a polyvinyl chloride (PVC) ETT wrapped with aluminum foil and wet cotton was used. Contact of the laser with the tube or cotton (which had dried) resulted in a fire and injury to both the trachea and pulmonary parenchyma.

REPORT OF A CASE

A 41-year-old man with carcinoma of the larynx was scheduled for a partial "laser" laryngectomy (Cavitron® infrared carbon dioxide laser, model AO 500). His past medical history was remarkable only for a 1 pack/day history of cigarette smoking. After premedication with 0.5 mg atropine, and 75 mg meperidine, im, anesthesia was induced with thiopental, fentanyl, diazepam, and succinylcholine. The trachea was intubated under direct vision with a polyvinyl chloride disposable endotracheal tube (N.C.C. 5 mm ID) that had been wrapped above the inflatable balloon with aluminum foil. The tube was positioned carefully with the wrapped portion extending several centimeters above and below the cords. A moistened cotton surgical sponge tied to a long tape was placed above the balloon of the ETT to shield the balloon from direct damage by the laser.

Anesthesia was maintained with *d*-tubocurarine, nitrous oxide, and enflurane. The tube was periodically checked for position and the protective cotton sponge was moistened periodically with saline. One hour following induction of anesthesia, the metal Yankaur suction was noted to be hot. Within seconds thereafter, smoke was noted to be emerging from the patient's mouth. It soon became impossible to ventilate the lungs through the ETT. The procedure was stopped and the endotracheal tube replaced. Examination of the endotracheal tube revealed that the tip was fused shut and the cuff perforated. With replacement of the endotracheal tube, ventilation of the lungs could be reinstituted. There was no clinical evidence that severe bronchospasm had occurred.

During laryngoscopy no remaining fragments of the ETT were found. The remainder of the operation proceeded uneventfully. The tip of the removed endotracheal tube and part of the surgical sponge were charred.

Laryngoscopy and bronchoscopy were performed at the termination of the operation and revealed an absent left cord (surgically removed), a dark swollen right cord, and mild supraglottic edema but no apparent edema below the level of the cord. Breath sounds were clear; respiration was not labored. With a $F_{I_{O_2}}$ of 100 per cent, pH_a was 7.35, Pa_{CO_2} 49 torr, and Pa_{O_2} 387 torr.

Three hours later upper airway obstruction secondary to severe supraglottic edema developed. An emergency tracheostomy was performed rather than endotracheal intubation because it was felt that there was a risk that complete obstruction could develop during laryngoscopy. The findings upon physical examination and chest roentgenographs were consistent with upper airway edema. The respiratory distress resolved following tracheostomy. After a 4-h period of observation in the recovery room, the patient was discharged to routine floor care.

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