

Pneumothorax with Upper Airway Laser Surgery

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The laser is a relatively new technology in the operating room from which new and unusual types of surgical complications are being discovered. We describe an unrecognized upper airway injury resulting in massive subcutaneous emphysema and bilateral pneumothorax.

REPORT OF A CASE

A 4-year-old girl was admitted for removal of recurrent juvenile papillomas of the vocal cords and subglottic area. The child had multiple previous procedures at another institution for this problem and related respiratory distress. Other review of systems was non-contributory.

Physical examination revealed a female child of normal stature with a labored respiratory rate of 24/min. Examination of the chest revealed mild suprasternal retractions, breath sounds were equal bilaterally, and the lungs were clear to auscultation. Otherwise, the physical examination was unremarkable. Complete blood count, urinalysis, and serum electrolytes were normal.

With no premedication, anesthesia was induced with nitrous oxide and halothane without difficulty. After induction and placement of a peripheral intravenous catheter, nitrous oxide administration was terminated and hyperventilation was instituted briefly with oxygen and halothane. A flexible metal endotracheal tube¹ (Norton, 4.0-mm ID) for laser surgery was placed without difficulty and equal breath sounds were auscultated bilaterally. A conventional circle system was used, and ventilation was controlled. Compliance was good and high pressures were not required for ventilation. The operative procedure lasted approximately one hour and 45 minutes, and the patient remained stable. After termination of the procedure, the metal tube was removed and a 4.5 Shiley oral tracheal tube was placed without difficulty. Again breath sounds were auscultated bilaterally and the child was taken to the recovery room with unlabored spontaneous ventilation.

After observation for 45 minutes there appeared to be minimal swelling of the neck. The trachea was extubated and the child placed in a tent with humidified 40 per cent oxygen. About 12 minutes after extubation, swelling of the anterior neck and chest was observed. Examination revealed an area of subcutaneous emphysema. Respirations were not labored and the child was awake without apparent distress. Several minutes of close observation indicated rapidly increasing subcutaneous emphysema and following re-intubation of the trachea, the neck was severely swollen and the face and entire chest involved with subcutaneous emphysema. With the endotracheal tube in place the child was not in serious distress and further increase in subcutaneous air was not noted. A portable chest roentgenogram was obtained in the

recovery room which revealed bilateral pneumothorax and the patient was returned to the operating room for tracheostomy. Halothane and oxygen were given with assisted ventilation. At operation a vertical laceration of the trachea of approximately 1.5 cm in length was found (fig. 1). This laceration violated the first and second tracheal rings. Tracheostomy was done between the third and fourth tracheal rings and the tracheal laceration (above this level) was sutured.

The child tolerated the procedure well and was returned to the recovery room. The portable chest roentgenogram revealed moderate bilateral pneumothorax for which chest tubes were placed.

The child subsequently did well. Serial chest roentgenograms were normal, the chest tubes were removed, and she was discharged home on the ninth postoperative day.

DISCUSSION

The hazards of laser surgery have emphasized eye injury to the patient and operating room personnel and

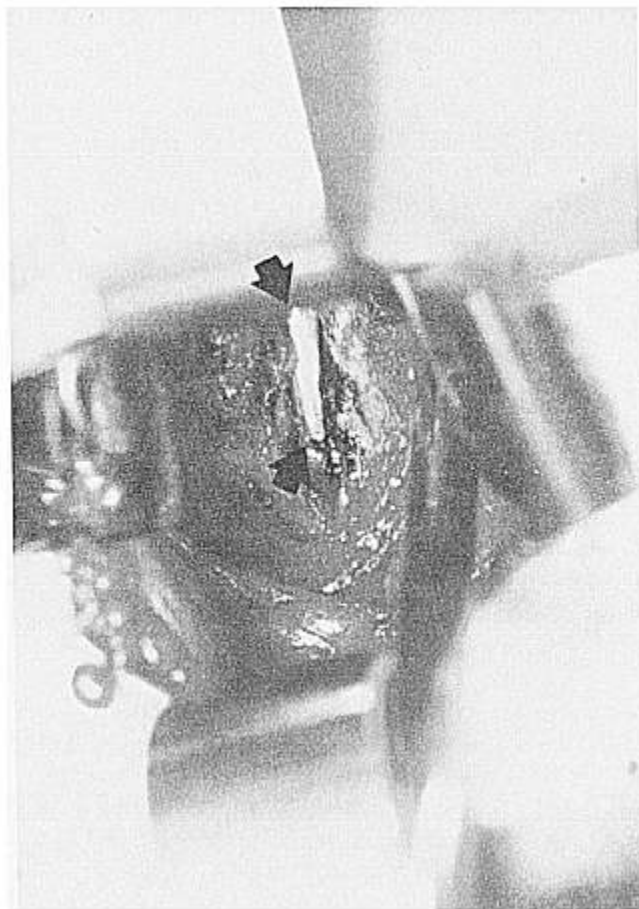


FIG. 1. After surgical exposure, the glistening endotracheal tube is seen through the longitudinally split trachea.

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possible ignition of the endotracheal tubes.^{2,3} Direct tissue injury to the patient at sites beyond the area of intended operation are not often discussed and apparently assumed to be understood by the user and associated operating room personnel. Unlike the scalpel which slips and damages an unintended structure a centimeter away, the laser does not mechanically touch the tissue and therefore does not offer the same tactile feedback to the operator. Vital structures some distance from the operative site may be injured by over-shoot of the laser beam or by reflection of the beam from a polished instrument and may be unnoticed.

In our case, the most reasonable explanation seems to be that the laser beam passed down the trachea striking it anteriorly in the course of removing papillomas located more superiorly. Other possible causes of the tracheal laceration include trauma from the endotracheal tube or a stylet. The authors feel these are unlikely causes. A plastic coated wire stylet was used, but the proximal end was folded over the end of the endotracheal tube so that the stylet did not protrude from the distal end of the endotracheal tube. Two attempts were made to intubate the trachea with the Norton metal tube. The Norton tube was cuffed on the first attempt and would not easily enter the trachea. The rubber cuff was removed and the Norton tube easily entered the trachea. The stylet was removed after the tip of the endotracheal tube passed the cords. There were no airway problems and no need to hurry or use force during the intubation. The incision of the anterior trachea was not recognized and no signs

were noted until after extubation of the trachea. The indwelling endotracheal tube probably covered the tracheal rent and eliminated most upper airway resistance. After removal of the endotracheal tube, a cough may have begun to force air into peritracheal tissue causing swelling and further increase in upper airway resistance. This would cause a positive feedback situation, more intratissue air causing more swelling, increased upper airway resistance, and a still greater tendency to force air out of the tracheal rent with exhalation. The peritracheal air would then dissect downward along the trachea causing pneumothoracies and rapidly producing a life-threatening situation.

Fortunately, the outcome was favorable, but without the constant vigilance of the recovery nurses and rapid reestablishment of the airway the patient might have expired in a few more minutes from bilateral tension pneumothoracies or from airway obstruction. Prior knowledge that such serious sequelae can result from misadventures in laser laryngeal surgery should prompt particularly close postoperative observation.

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