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## Difficult Endotracheal Reintubations: A Simple Technique

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A critically ill patient is at risk when a change in his or her endotracheal tube (ETT) is required urgently. The initial endotracheal intubation may have been accomplished with great difficulty, and reintubation can be even more difficult. Alternatively, the conditions posing difficulties with reintubation may have developed after the initial intubation: for example, the patient may develop upper airway and facial edema after massive trauma or burns.

We describe two patients who required reintubation of the trachea. In each case, the initial intubation was accomplished with great difficulty, and the conditions at the time of reintubation were even more unfavorable. We describe the method used for the successful rapid change of the ETT using a fiberoptic bronchoscope. We believe the method will prove to be effective and safe in other situations in the operating room and in the intensive care unit.

### REPORT OF TWO CASES

*Case 1.* The patient was a 48-yr-old 86-kg man who was scheduled for an excision of a posterior fossa brain tumor. He was mentally alert and oriented to person, place, and time. He showed no ocular signs of increased intracranial pressure. On preanesthetic assessment, he was mildly obese. His dentition was full and normal. His mouth opening and neck extension were assessed to be normal. His chest showed an increase in A-P diameter, while his vital capacity was judged clinically to be about 3.0 l. His expiratory time was assessed subjectively as "prolonged." On auscultation, occasional expiratory wheeze was heard, but the chest was otherwise clear. Lateral neck radiograph ordered by the neurosurgical service showed no abnormality of the airway, neck bones, or jaw. No preoperative sedative or antisialagogue was ordered.

On arrival in the preanesthesia room, lactated Ringer's solution was being infused. After 3 min of breathing 100% oxygen, anesthesia was induced with iv fentanyl 250 µg, pancuronium bromide 10 mg, and thiopental 325 mg. When the patient became apneic, he was ventilated gently *via* a mask with 100% oxygen for an additional 3 min until

adequate relaxation for endotracheal intubation was obtained. Laryngoscopy was attempted with a #3 Macintosh blade without adequate exposure of the larynx as it was too far beyond the tip of the blade and quite anterior. The patient was ventilated *via* mask, and repeated laryngoscopy with a #4 Macintosh® blade was performed. The blade reached the vallecula but, even with laryngeal pressure from an assistant, the arytenoids were barely visible. Hyperventilation was continued with 100% oxygen, and anesthesia was supplemented with 75 to 100 mg doses of thiopental iv while repeated brief attempts were made to intubate the trachea with a #8 and #9 armored tube. A variety of neck positions and straight blades were used, all without success. After about 20 min, the trachea was intubated with a cuffed 9 mm ID disposable tube (Portex®) with considerable difficulty.

The surgery required the patient to be prone, with the neck in an extreme flexed position. After some discussion with the surgeon, we reaffirmed that the protection against kinking afforded by an armored tube was necessary. The thick, copious secretions and mild bleeding resulting from our initial attempts at intubation continued to preclude a rapid fiberoptic bronchoscope-assisted intubation. Instead, we used the fiberoptic bronchoscope placed through the old ETT as an introducer. The bronchoscope stayed in place during the removal of the original disposable tube and served as a guide to direct the placement of the replacement ETT. It also allowed confirmation of proper placement. The time to replace the ETT using this method was approximately 20 s.

*Case 2.* A 54-yr-old man with diffuse histiocytic lymphoma was admitted to the intensive care unit (ICU) 4 days previously for management of progressive respiratory obstruction caused by large tumor masses in his neck.

On arrival in the ICU, he suffered a respiratory arrest. At that time, his trachea was successfully intubated with a 8 mm disposable ETT. The next day he underwent surgical exploration, biopsy, and radiation to the neck tumors. This was followed by progressive massive swelling of the neck and face.

On the fourth day after admission, ventilator airway pressures were suddenly increasing breath by breath. Attempts to pass a suction catheter failed because of an obstruction in the ETT. The obstruction became complete over about 30 min. It was cleared only temporarily by passage of a coated ETT stylet (NCC Satin-Slip® Intubating Stylet). Fiberoptic exploration revealed a very thick, tar-like material in a localized area near the tip of the ETT. This could not be cleared with suction or repeated passes of the fiberoptic scope. Despite our best efforts, the ETT continued to obstruct repeatedly, once resulting in a cardiac arrest from which the patient was resuscitated after the ETT was again cleared. At this point, it became clear that the ETT would have to be changed, despite the obvious risk.

The described technique was once again used. The patient was apneic for about 30 s during the changeover.

### METHOD OF ETT PLACEMENT

The method we used is illustrated by photographs taken using a mannequin. In addition to the fiberoptic bron-

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FIG. 1. The arterial forceps cover the point of the scalpel blade to prevent injury to the patient or bronchoscope.

choscope, the only items required are the replacement ETT, small arterial forceps, a #11 scalpel blade, and a Kocher's clamp. The #11 scalpel blade is placed in the jaws of the arterial forceps so that the cutting edge protrudes and the point is between the jaws (fig. 1). The appropriate replacement ETT is mounted onto a well-lubricated fiberoptic bronchoscope and held at the proximal end of the instrument by a small piece of tape. After 5 min of preoxygenation, lubricant-moistened gauze is placed around the lips to prevent accidental laceration. The connector is removed from the original ETT (which may have to be cut below the connector, as occurred in both our case), and the proximal end of the original tube is held with the Kocher's forceps. The bronchoscope with

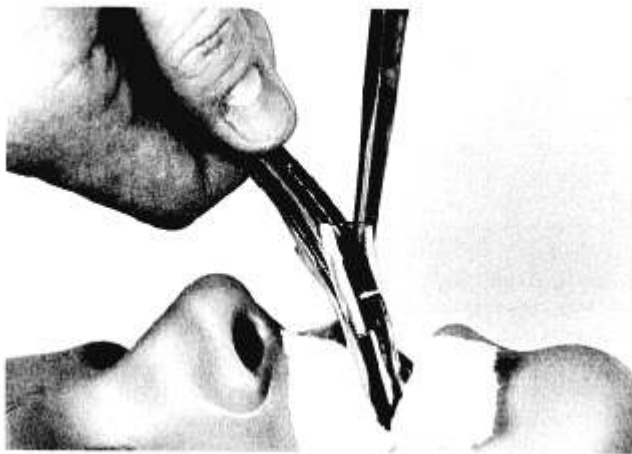


FIG. 2. The bronchoscope and arterial forceps with the scalpel blade are held in one hand, with the sharp edge of the blade radiating outward against the old endotracheal tube. The other hand holds the Kocher's forceps attached to the proximal end of the original endotracheal tube.

the mounted replacement ETT is passed into the original tube. While an assistant supports the end of the bronchoscope, the arterial forceps with the blade is placed beside the bronchoscope at the opening of the original ETT taking care to keep the sharp edge of the blade pointing away from the bronchoscope (fig. 2). The arterial forceps and the bronchoscope should be held together with the same hand so that they do not move in relation to each other. After letting down the cuff of the original ETT, steady, constant traction is applied to the Kocher's forceps to extract the original ETT while countertraction on the arterial forceps and bronchoscope keeps the bronchoscope from slipping out. As the original ETT is extracted, the scalpel blade continuously slices the ETT along its length. After the original ETT is removed, proper position of the bronchoscope in the trachea can be checked, and the replacement ETT can be advanced over the bronchoscope into the trachea. Once again, proper position can be confirmed by seeing the trachea through the bronchoscope.

#### DISCUSSION

The effective use of a fiberoptic bronchoscope or laryngoscope to aid in the difficult endotracheal intubation is well accepted.<sup>1-3</sup> Because of the problem of getting rid of the replacement ETT, its use for reintubation has required the fiberoptic scope to be outside the original ETT before its removal.<sup>4</sup> It can be placed either beside or through the larynx. The danger in this practice is pulling out the fiberoptic bronchoscope with the original ETT and/or not being able to pass the fiberoptic bronchoscope through the larynx before the patient suffers from excessive apnea. The technique described in this report assures the continued proper position of the fiberoptic bronchoscope. The technique for passing replacement ETT into the trachea using the fiberoptic bronchoscope as a guide is unchanged from known practice.

The use of other guides such as urethral guides and suction catheters may allow the removal of the original ETT but pose other problems. If they are too stiff, they may cause damage to the trachea during the manipulation. If they are too flexible, they may not offer sufficient guidance to the replacement ETT for proper placement. These guides leave too much of the advancing edge of the ETT exposed and, thus, it may get hung up on the epiglottis and glottis and not enter the larynx. The fiberoptic bronchoscope, on the other hand, is sufficiently soft and flexible at the tip and is unlikely to cause tracheal damage, yet is sufficiently firm and has a wide enough diameter for reliable guidance of an ETT into the larynx. It has the advantage of allowing immediate confirmation

of position before and after advancing the ETT. If the fiberoptic bronchoscope accidentally slips out of the trachea during the maneuvering, it allows immediate recognition and institution of attempts to reestablish the airway.

We believe that this technique has application when difficulty in reintubation can be anticipated and where one would expect an ETT to pass over a suitably placed fiberoptic bronchoscope into the trachea. It may also be found to be useful in replacing endotracheal tubes in very ill patients who may not tolerate the stress of prolonged apnea, direct laryngoscopy, or anesthetic agents.

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## Pulmonary Aspiration after a Priming Dose of Vecuronium

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Patients in danger of aspiration of gastric contents during induction of anesthesia require special techniques to protect their airway. If awake tracheal intubation cannot be safely accomplished, a rapid sequence of anesthesia-induction-endotracheal-intubation technique is used. A muscle relaxant with a rapid onset of paralysis is important because tracheal intubation should be performed as expeditiously as possible to minimize the period of vulnerability to aspiration. Succinylcholine is often used for this purpose. However, there are several conditions in which the side effects of succinylcholine might render it undesirable or contraindicated.<sup>1-3</sup>

Recently, several investigators have suggested using a medium-duration, nondepolarizing neuromuscular blocking drug, vecuronium or atracurium, to provide relaxation. To overcome the longer onset time of these muscle relaxants, they have suggested the drugs be given in two stages. First, a small, nonparalyzing dose is given. After a suitable period of time, anesthesia is induced, and the remainder of the muscle relaxant is given. Following the second administration of the muscle relaxant, the paralyzing dose, adequate relaxation can be obtained in one-half to two-thirds the time required when the full dose is

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administered as a single bolus. This practice has been popularized as the "priming principle."<sup>4-6</sup>

We report the use of the priming principle for rapid sequence induction of anesthesia and tracheal intubation in a patient with a full stomach and open eye injury to illustrate a possible complication of this technique.

## REPORT OF A CASE

A 49-yr-old, 102-kg man was scheduled for repair of a ruptured eye. He had consumed an unknown quantity of alcohol 1 h before an auto accident. His past medical history was significant for hypertension, a 40 pack yr smoking history, and consumption of four to five drinks of alcohol daily. He was taking triamterene and hydrochlorothiazide for hypertension. Arterial blood pressure was 120/80 mmHg. Except for swelling and ecchymosis over the left periorbital region and tenderness to palpation over the lateral left lower rib cage, the physical examination, including cardiac, pulmonary, and nervous system, was within normal limits. Chest roentgenogram showed mild cardiomegaly and increased interstitial markings. His hematocrit was 44%, potassium was 3.1 mEq/l, and creatinine was 1 mg/dl.

On admission to the ward, an iv infusion was begun. Gentamicin 110 mg, vancomycin 500 mg, and potassium chloride 20 mEq then were given iv 4 h before the operation. Metaclopramide 10 mg orally and cimetidine 300 mg iv were given 3 h before the operation. Meperidine 100 mg and hydroxyzine 50 mg were administered im 2 h later. The patient was considered at risk for aspiration of stomach contents, and a rapid sequence induction-intubation employing cricoid pressure was planned, using vecuronium and the priming principle.

After 4 min of breathing oxygen, vecuronium 2 mg (0.02 mg/kg) was given iv. In less than 1 min the patient became agitated and complained of weakness and difficulty breathing. Cricoid pressure was applied; thiopental 500 mg and vecuronium 8 mg were given iv in rapid sequence. Stimulation of the ulnar nerve revealed a single, weak twitch response. Direct laryngoscopy and endotracheal intubation were performed, the endotracheal cuff was inflated, and the cricoid pressure was released. The pharynx was noted to be clear during laryngoscopy.

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