In summary, we recommend intravenous regional sympathetic blocks with 1 mg/kg bretylium as a rational and effective treatment of reflex sympathetic dystrophy. Use of higher doses may be warranted, but our experience is limited.

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An Abnormal Epiglottis as a Cause of Difficult Intubation—Airway Assessment Using Magnetic Resonance Imaging

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Many factors can contribute to a difficult tracheal intubation, several of which are readily apparent on physical examination.[1-4] In the case described below, the trachea of a patient with an apparently normal physical examination proved difficult to intubate under direct visualization and with a flexible fiberoptic bronchoscope.

Subsequent magnetic resonance imaging (MRI) revealed an elongated epiglottis which had an unusual angulation in respect to the base of the tongue. This airway problem has not been described in the literature, and, yet, we believe that the size and angulation of the epiglottis may be the etiology of some difficult tracheal intubations. This case also illustrates the remarkable ability of MRI to highlight the soft tissue anatomy of the head and neck. Because of this quality, MRI often may be useful when evaluating patients with tracheas that have been or potentially will be difficult to intubate.

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Key words: Intubation, endotracheal: difficult. Measurement techniques: magnetic resonance imaging.

Report of a Case

A 68-yr-old woman (152 cm, 66 kg) was scheduled to undergo a scalene node biopsy for evaluation of enlarged lymph nodes. On physical examination, she appeared healthy. Her neck was long and supple. She had normal temporomandibular joint function and was able to open her mouth well (5 cm). Examination of her mouth revealed full dentition, and the faucial pillars, soft palate, and uvula were visualized directly. The distance between the thyroid notch and the mental protuberance of her mandible was 9 cm.

Following induction of anesthesia, ventilation was controlled easily *via* a mask. The epiglottis was visualized easily, but varying head and neck position, use of straight and curved laryngoscope blades, and

dorsal depression of the thyroid cartilage failed to reveal the glottis. The trachea was intubated without direct visualization of the glottis using an Eschmann Introducer for Endotracheal Tube (Eschmann, Lancing, Sussex, BN15 8TJ, England). The epiglottis was visualized, and the angled tip of the Eschmann introducer was directed in the midline, immediately posterior to the epiglottis into the trachea. A 7.5-mm ID endotracheal tube was threaded over the Eschmann introducer into the trachea, and its position was confirmed both by auscultation and by the carbon dioxide waveform of the mass spectrometer. The patient tolerated the intubation, surgery, emergence, and extubation well, and was taken to the recovery room in good condition.

Two weeks later, the patient was scheduled to undergo an abdominal laparotomy for splenectomy and staging of the lymphoma that was diagnosed as a result of the first surgical procedure. Sedation, supplemental oxygen, and topical anesthesia were administered. An awake endotracheal intubation was undertaken using an Olympus LF-1 Flexible Fiberoptic Bronchoscope through a 7.5-mm ID endotracheal tube introduced into the oropharynx *via* a Williams Airway Intubator (Anesthesia Associates, Inc., San Marcos, CA). The epiglottis was visualized easily, but it was impossible to manipulate the tip of the bronchoscope in the midline beyond the epiglottis. The trachea was intubated by maneuvering the tip of the bronchoscope *around* the epiglottis and into the trachea. The case proceeded uneventfully.

Following her recovery from surgery, the patient underwent MRI of head and neck to determine possible anatomic causes for the difficulty with intubation. With her head and neck in as near stiff position as possible in the Gyroscan, several images were obtained. The MRI sagittal section (fig. 1) reveals a large, elongated epiglottis (arrow). The proximal half of the epiglottis forms an angle of approximately 90° with the base of the tongue. After making a 90° angle at mid-point, the distal half of the epiglottis abuts the posterior pharyngeal wall.

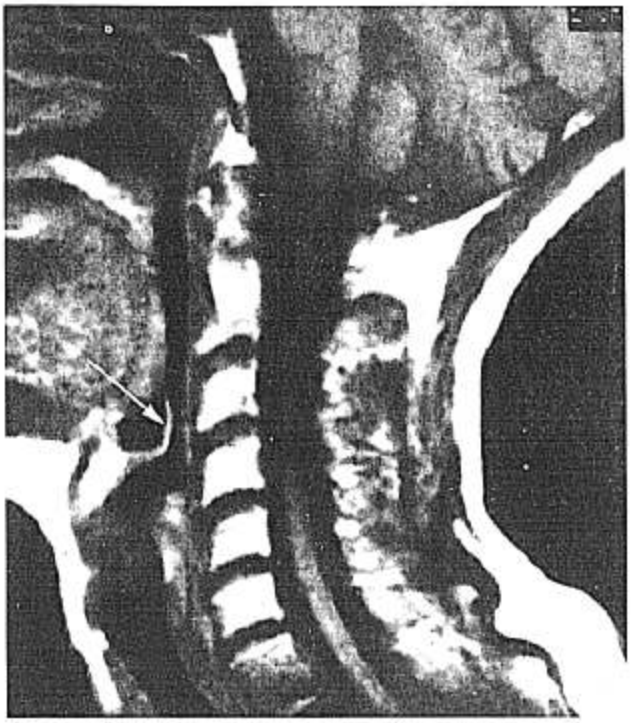

FIG. 1. Magnetic resonance image showing elongated epiglottis (arrow). Proximal portion of epiglottis obtains a 90° angle with the base of tongue. Distal portion of epiglottis abuts the posterior pharyngeal wall.

DISCUSSION

Several structural and functional factors can render direct laryngoscopy difficult, including pain and dysfunction of the temporomandibular joint; cervical spine disease; decreased distance between the occiput and the spinous process of the C1 vertebra;[5,6] decreased distance between the thyroid notch and the tip of the mandible;¶ inability to visualize the faucial pillars, soft palate, and uvula;[3] and increased posterior and anterior depths of the mandible.[2,5] None of these problems were apparent in our patient, including the atlanto-occipital gap, which was assessed on a postoperative lateral head and neck roentgenogram.

Many epiglottic abnormalities have been reported, including neoplasms, sarcoid, hematoma, tuberculosis, cysts, infective processes, edema, and congenital defects.[7] Reported congenital laryngeal defects involving the epiglottis, though rare, include bifid epiglottis, epiglottic hypoplasia, and absent epiglottis.[8] To date, there have been no reports of abnormal epiglottic size, shape, or position producing intubation difficulties in patients without the aforementioned problems. We believe that this case represents another cause of the difficult endotracheal intubation; namely, an epiglottis with abnormal size and angulation in relationship to the glottic opening.

Although, in most cases, it is possible to displace the epiglottis indirectly with the tip of the curved laryngoscope blade in the vallecula or directly with a straight laryngoscope blade, endotracheal tube, or endotracheal tube introducer, we postulate that, in some individuals, this may be difficult or impossible. The epiglottis of increased size also may be responsible for some assessments of an "anterior larynx," which frequently is cited as the cause for the difficult intubation.

This case illustrates the utility of the Eschmann introducer. When the epiglottis can be identified, often it is possible to place the curved tip of the Eschmann introducer into the glottis without actually visualizing the glottis, thus securing access to the trachea. Then, by advancing the endotracheal tube over the Eschmann introducer, intubation can be accomplished.

Several radiologic techniques are available for assessing the airway, including lateral roentgenograms with soft-tissue technique and conventional tomography. Computed tomography, including phonation techniques, offer certain advantages, including visualization of midline structures.[9,10] However, all three techniques require patient exposure to ionizing radiation.

Magnetic resonance imaging, on the other hand, provides the advantages of superior soft-tissue contrast res-

¶ Patil VU, Stehling LC, Zauder HL: Predicting the difficulty of intubation utilizing an intubation gauge. Anesth Rev 10:32–33, 1983

olution and multiplanar imaging capabilities without patient exposure to ionizing radiation.[11] For these reasons, many investigators feel that MRI is useful for the investigation of disorders of the upper aerodigestive tract; specifically, the larynx and hypopharynx.

This case demonstrates how difficult it can be to predict in which patients endotracheal intubation will be difficult, even when they have been assessed using the numerous criteria reported. The epiglottis must not be overlooked as one of the factors which can cause difficulty with intubation. Since there is certainly not one cause for all difficult intubations, airway assessment must be as comprehensive as possible, while producing the least risk to the patient. In this regard, MRI offers a unique tool in that it is not invasive and produces no ionizing radiation exposure, yet it provides excellent detail of airway structures. For these reasons, MRI provides the means for prospectively and retrospectively assessing the difficult airway.

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Identification of Inadvertent Intravenous Placement of an Epidural Catheter in Obstetric Anesthesia

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One of the complications of epidural analgesia and anesthesia is an unrecognized puncture of an epidural vessel by the needle or the epidural catheter, followed by accidental intravascular (iv) injection of the local anesthetic. Aspiration before injecting is recommended, but may not be entirely reliable.[1,2]

We recently described an effective and safe test dose, which could be very useful in obstetric epidural anesthesia,[3] especially if combined with an improved technique to monitor maternal heart rate (MHR) using a cardiotocograph.[4] We found that a test dose, consisting of 12.5 mg of bupivacaine plus 12.5 μg of epinephrine in 10 ml of physiologic saline, injected in a peripheral arm vein over 30 s, gives a predictable and easily detectable increase in heart rate and arterial blood pressure, provided that the patient is adequately monitored.[3] We speculated that a similar result would be seen if the test dose were injected in an epidural vein in a pregnant patient. We now report two cases of obstetric epidural analgesia, where the test dose was administered through an epidural catheter located in an epidural vein; intravascular injection was demonstrated clearly.

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Key words: Anesthetic techniques: epidural; regional. Complications: intravascular injection.

Report of Two Cases

Case 1. A 21-yr-old healthy primigravida (height 159 cm, weight 67 kg) presented at term for delivery under epidural analgesia. Because