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MR Evaluation of Epiglottic Disruption

John J. Duda, Jr, Jonathan S. Lewin, and Issac Eliachar

Summary: Epiglottic disruption is an uncommon injury usually associated with significant supraglottic trauma. This injury may be overlooked because of the difficulty in examining the larynx or other associated severe injuries. We present two cases of clinically unsuspected epiglottic disruption that were first seen on MR images of the neck.

Index terms: Larynx, epiglottis; Neck, injuries; Neck, magnetic resonance

Clinical examination of patients with neck trauma is often difficult because of marked soft-tissue swelling, hematoma, and other severe associated injuries. The initial radiologic examination may include plain films to identify soft-tissue swelling, extraluminal air, and concomitant trauma such as cervical spine injury, and computed tomographic (CT) examination to identify luminal compromise or cartilaginous injury.

Magnetic resonance (MR) examination of patients with neck trauma is usually not performed in the acute setting owing to its sensitivity to motion and longer examination time, which may be prohibitive in patients with other life-threatening injuries and airway fragility; its availability and cost are also limiting factors. However, in the evaluation of subacute or chronic laryngeal trauma, the multiplanar imaging capabilities and superior contrast resolution of MR imaging offer advantages over other imaging procedures. These capabilities are of particular advantage in evaluation of the sagittally oriented epiglottis. We present two cases that demonstrate the usefulness of MR imaging in defining significant supraglottic laryngeal injury with epiglottic disruption.

Case Reports

Case 1

A 67-year-old woman sustained a "clothesline" type injury to her neck as a result of a motor vehicle accident. On initial examination at an outside institution, there was marked swelling of the neck with crepitus. The patient underwent emergency laryngoscopy and bronchoscopy. Clinical evaluation of the pharynx was limited because of bleeding, marked edema, and hematoma. A tracheostomy was performed. A CT scan of the neck at that time showed marked edema/hematoma in the region of the supraglottic larynx with lacerations involving the posterior hypopharyngeal wall and supraglottic airway. Follow-up endoscopic examinations revealed injury to the cervical esophagus at the level of the cricopharyngeus and the trachea with eventual formation of a tracheoesophageal fistula. There was also a noticeable decrease in the patient's capacity for voice production. Subsequently, supraglottic, glottic, and subglottic stenosis developed.

Upon transfer to our institution, the patient had an MR examination of the neck, approximately 8 months after the traumatic event. On the T1-weighted sagittal image (Fig 1A), increased soft tissue was seen in the preepiglottic space. The epiglottis was torn or disrupted with the larger inferior portion of the epiglottis displaced posteriorly and with the upper half of the epiglottis essentially becoming a free fragment and remaining more anterior in position. The axial and coronal T1-weighted images (Fig 1B and C) showed an apparent abnormality of the preepiglottic space (Fig 1D is a normal T1-weighted sagittal MR image of the neck for comparison). At surgery for laryngotracheal reconstruction, the epiglottis was found to be disrupted in its middle portion; the patency of the airway was restored, and the patient subsequently regained her voice and swallowing ability.

Case 2

A 45-year-old man was involved in a motor vehicle accident and suffered extensive neck and facial injuries. The patient was initially seen at an outside institution. At

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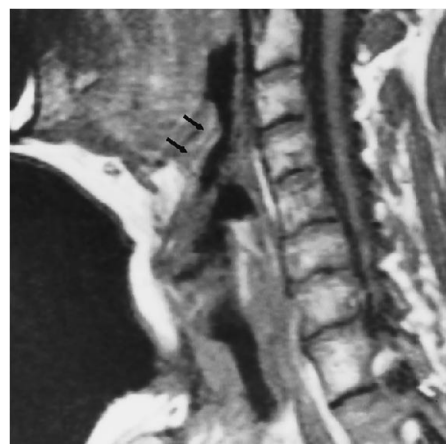
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Fig 1. A–C, Case 1: 67-year-old woman with epiglottic disruption.

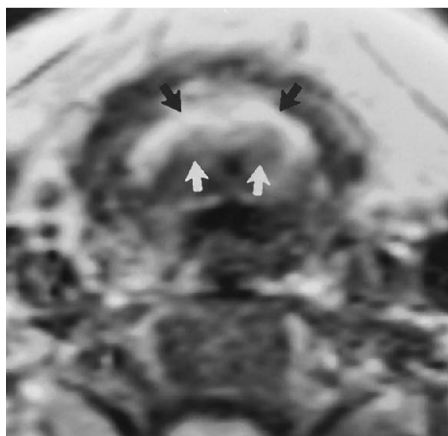
A, Sagittal T1-weighted MR image shows absence of the normal epiglottic contour, with discontinuity between the upper fragment of the epiglottis, in more normal position (*arrows*), and the retropositioned inferior portion. The study fails to show an intact thyrohyoid membrane, suggesting associated injury to this structure.

B and C, Axial (B) and coronal (C) T1-weighted images show the widened preepiglottic space better. Fat (*black arrows*, B and C) and scar tissue formation, which is more hypointense in signal intensity (*white arrows*, C), are also seen.

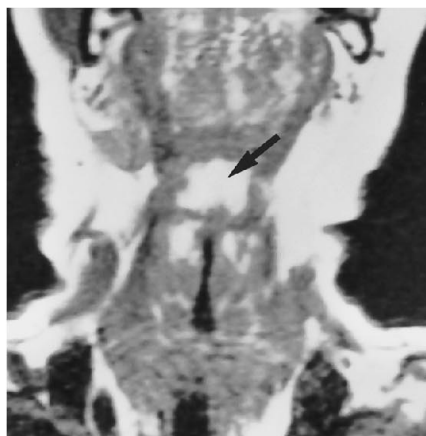
D, Sagittal T1-weighted image of the neck of another patient for comparison shows the normal appearance of the epiglottic contour and preepiglottic fat.



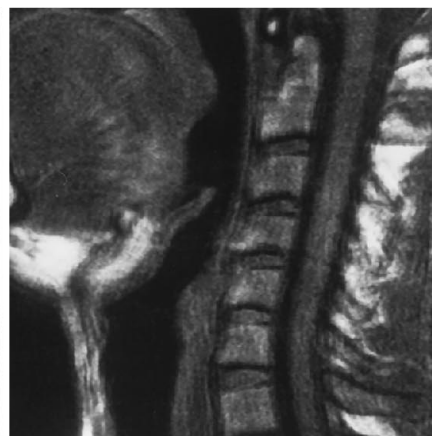
A



B



C

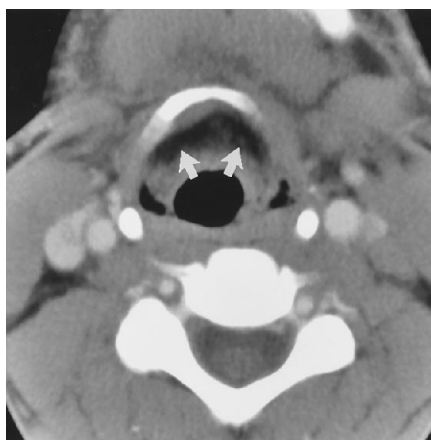


D

Fig 2. Case 2: 45-year-old man with epiglottic disruption and avulsion.

A, Axial CT scan shows widening of the preepiglottic space (*arrows*).

B, Sagittal T1-weighted MR image shows loss of the normal epiglottic structure and increased preepiglottic fat (*small arrows*). The epiglottis was disrupted at the level of the petiole (*large arrow*). Tracheostomy soft-tissue defect is from prior surgery.



A



B

the time of injury, a tracheostomy was performed because of severe laryngeal trauma. A CT scan showed thyroid cartilage fractures along with marked swelling and compression of the airway. At that time, facial and mandibular fractures required facial reconstructive surgery and arch bar placement. After initial surgery, the patient was lost to follow-up. He came to our institution approximately 1 year after the injury. On laryngeal fiber-optic endoscopic examination, the epiglottis appeared retropositioned with decreased anteroposterior diameter of the supraglottic airway. Deformity of the thyroid cartilage was also noted, consistent with laryngeal fracture. CT examination suggested a widened preepiglottic space (Fig 2A). MR imaging confirmed epiglottic injury, showing retrodisplacement of the epiglottis at the level of the petiole (its thin inferior process), and defined the extent of epiglottic retropositioning and anteroposterior supraglottic stenosis (Fig 2B). A defect was seen in the junction of the lower and middle third of the epiglottis, as evidenced by fat extending into the normal area that was of lower T1 signal intensity. At surgery, the epiglottis was disrupted at the level of the petiole. Reductive repositioning of the retrodisplaced epiglottis was done through an infrahyoid surgical approach. The patient's supraglottic stenosis was relieved with eventual restoration of normal voice function and ventilation.

Discussion

Laryngeal injury is usually caused by a compressive force to the anterior portion of the neck, crushing the larynx against the cervical vertebrae. Penetrating injuries from stab or gunshot wounds are also causes of laryngeal trauma. Injuries can range from mucosal edema, hematoma of the laryngeal soft tissues, or mucosal tears to fractures or displacement of the hyoid, thyroid, cricoid, or arytenoid cartilages, which may be associated with vocal cord disruption or pharyngeal or esophageal injury (1).

Laryngeal stenosis is a serious long-term complication of laryngeal trauma. Delayed diagnosis may contribute to secondary infection and subsequent cicatrization. Clinical and radiologic examination may be difficult in this setting, as laryngeal fractures are easily overlooked once the airway has been secured and may be overlooked during initial examination and emergency treatment because of marked edema or hematoma or concern over other life-threatening injuries (2).

Currently, CT of the neck is used in the acute setting at most institutions to evaluate for possible cartilaginous fractures and soft-tissue injury, especially when laryngoscopic examination is difficult (3, 4). Indications for CT in

patients with neck trauma generally include signs and symptoms of cervical and laryngeal injury or a mechanism of trauma known to cause such injuries (5, 6). Spiral CT may prove to be an excellent method for evaluating neck trauma because of its short examination time.

MR imaging has been used in the nonacute setting for evaluation of long-term complications of trauma, and has been found useful in the management of posttraumatic deformities of the laryngeal cartilages and mucous membranes. For example, a patient with an old undiagnosed fracture of the larynx may have a palpable neck pseudomass long after trauma, which represents the healed deformed fracture (7). MR imaging has also been used to examine and treat patients with posttraumatic glottic stenosis (E.I. and J.S.L., unpublished data, 1993).

Our two cases document MR findings of epiglottic disruption that are somewhat similar to reported CT findings, including widening of the preepiglottic space and displacement of the epiglottis at the level of the petiole (Fig 3). As the hematoma in the preepiglottic space resolves, increased fat or scar tissue may be seen (Fig 1). Fat will appear as high signal with T1 weighting. Scar should appear as hypointense or intermediate signal on T1-weighted images. The preepiglottic space may appear prominent or widened. Unlike axial CT, MR imaging in the sagittal plane can directly demonstrate the epiglottic injury rather than rely on secondary signs, such as widening of the preepiglottic space, which may be a more subjective finding. In both patients in this report, the epiglottic injury was best depicted on sagittal T1-weighted images.

The epiglottic cartilage is normally ovoid in configuration, usually concave posteriorly. This posterior concavity is usually well demonstrated on axial MR images through the body of the epiglottis. The short, thin, inferior process of the epiglottis, called the *petiole*, attaches to the thyroid cartilage via the thyroepiglottic ligament. Normally, the epiglottis has low to intermediate T1 signal intensity on MR images. The preepiglottic space, extending anterior to the body of the epiglottis from the thyroepiglottic ligament inferiorly to the hyoepiglottic ligament superiorly, contains a small amount of fat. The epiglottis is susceptible to disruption from shearing or crushing forces to the thyroepiglottic ligament, the petiole, or the body of the epiglottis. Disruption is fairly uncommon, but does

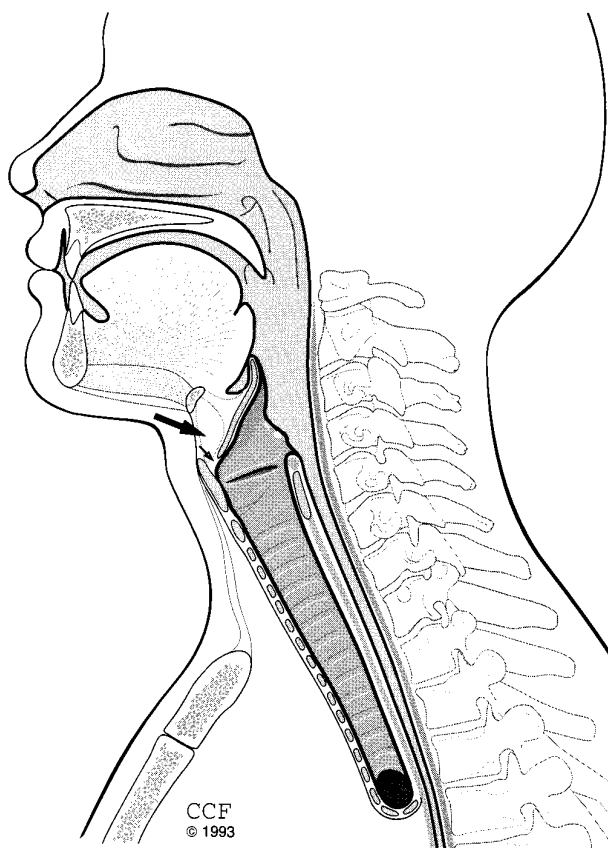


Fig 3. Diagram of neck after epiglottic avulsion. The epiglottis is avulsed and retropulsed from the thyroid cartilage at the thyroepiglottic ligament (small arrow). There is also an increase in the normal fat in the preepiglottic space (large arrow).

occur in supraglottic injuries. The epiglottis is displaced posteriorly to cover and obstruct the supraglottic introitus into the larynx. In a true epiglottic avulsion, the epiglottis is disrupted at the petiole, as in case 2. A more superior disruption, passing through the epiglottis itself, is referred to as an *epiglottic tear*. Epiglottic injury may be associated with transverse and vertical fractures of the thyroid cartilage, and one or both arytenoids may be dislocated (1). Epiglottic disruption can be diagnosed on physical examination if there is extensive posterior displacement of the epiglottis from the anterior supraglottic larynx, but evaluation is often extremely difficult.

Therapy may consist of placement of a stent to maintain the airway and support the epiglottis back into its normal position. As an alternative, partial supraglottic horizontal hemilaryn-

gectomy, or epiglottectomy, for complete transection of the epiglottic cartilage may be undertaken (8, 9). The therapy used depends on the severity of trauma and the timing of the treatment relative to the injury. In these two reported cases, a surgical method was used in which the epiglottic petiole was reattached to the thyroid cartilage, thus reducing the dislocation and reinstating the normal position and function of the larynx.

Several articles describing the CT findings of acute epiglottic avulsion have been published (4, 9, 10). In those cases, there was an increase in the preepiglottic space by hematoma. Two cases were also associated with thyroid cartilage fractures, as was case 2 in our study.

In summary, although epiglottic injury is uncommon, it does occur with supraglottic trauma and when discovered will significantly alter treatment. We have documented two cases of unsuspected epiglottic injury in which MR imaging was crucial in diagnosis and surgical planning. MR examination provides characteristic findings in epiglottic disruption or avulsion, including direct visualization of epiglottic disruption, and should be considered in the subacute or chronic setting in patients who have complex laryngeal injuries or in whom epiglottic injury is suspected.

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