Cricoid and Thyroid Cartilage Fracture, Cricothyroid Joint Dislocation, Pseudofracture Appearance of the Hyoid Bone: CT, MRI and Laryngoscopic Findings

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Abstract
We report a case of cricoid and thyroid cartilage fracture and cricothyroid joint dislocation after blunt neck trauma. Direct fibreoptic laryngoscopic, computed tomography (CT) and magnetic resonance imaging (MRI) findings were disscussed. Pseudofracture appearance of the hyoid bone were reviewed. 

Key words: Cartilage, computed tomography, endoscopy, fracture, magnetic resonance imaging

Introduction
Laryngeal trauma is extremely rare and usually occurs as a result of blunt trauma. The most common cause of the blunt laryngeal trauma is a motor vehicle accident but it can also occur as a result of relatively minor insults to the anterior neck that cause posterior compression of the larynx against the spine.

Injury to the larynx may range from simple mucosal tears to laryngeal cartilage fracture and dislocation. It may be associated with hyoid fractures, epiglottic injury, cervical spine fractures and esophageal or vascular injuries. As it may lead to life-threatening airway obstruction, rapid and accurate diagnosis is essential for proper treatment.

We report computed tomography (CT), magnetic resonance imaging (MRI) and serial endoscopic findings of a patient with cricoid and thyroid cartilage fracture and cricothyroid joint dislocation after blunt neck trauma.

Case Report
A 84-year-old man, with blunt neck trauma after falling down, presented to the emergency department with dyspnea. He had stridor, dysphagia, dysphonia and neck ecchymosis. Laryngeal injury was suspected by the history and physical examination. After ruling out cervical trauma with radiography and clinical examination, direct fibreoptic laryngoscopy and contrast-enhanced CT was performed.

The direct fibreoptic laryngoscopic examination showed severe swelling and hemorrhage of the epiglottis, left aryepiglottic fold, left vocal cord and left lateral and posterior pharyngeal wall that nearly closed the rima glottis (Figure 1). Bilateral vocal cord movements were normal. Computed tomography with coronal and sagittal reformarion revealed swelling in the mucosa (Figure 2a, b), multiple minimally displaced cricoid cartilage fractures, a nondisplaced linear thyroid cartilage fracture and cricothyroid joint dislocation (Figure 3a, b). There was an asymmetric linear line in the hyoid bone with synchron-
Drosis of the hyoid bone, which was initially suspected as a hyoid bone fracture (Figure 3c). Magnetic resonance imaging was obtained for a potential vascular dissection but images were degraded because of motion artifacts. There was no vascular injury. On T1 and fat suppressed T2 weighted images, the edema and hemorrhage of the left vocal cord, aryepiglottic fold, lateral and posterior pharyngeal wall were well demonstrated. On T1 weighted images fracture of the cricoid and thyroid cartilage were evaluated (Figure 4a-c).
The patient was treated conservatively, including continuous monitoring of the clinical symptoms. Swelling and hemorrhage of the upper airway were followed by repeated direct fibreoptic laryngoscopy. The symptoms completely disappeared after one week. Laryngoscopic examination at the end of the second week showed regression of the swelling and hemorrhage. The patient was discharged after the last laryngoscopy without complication. Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Discussion

Laryngeal trauma is a rare condition because the larynx is protected by the mandible, sternum, cervical spine and sternocleidomastoid muscle. This protection is amplified in the pediatric population secondary to the high position of the larynx and its elastic nature. Laryngeal fractures are more common in older persons because of calcification of the laryngeal cartilages.

Trauma to the larynx usually occurs as a result of a blunt trauma. Motor vehicle accidents are the most common cause. Clothesline injury, manual strangulation, hanging, penetrating injury and iatrogenic injury from intubation may cause laryngeal trauma (1). Blunt injuries can also occur as a result of relatively minor insults to the anterior neck that cause posterior compression of the larynx against the spine, as with our patient (2).

Common signs of laryngeal trauma include stridor, dyspnea, cough, hemoptysis, dysphonia, dysphagia, subcutaneous emphysema, hematoma and neck ecchymosis. A high degree of suspicion is the most important factor for the early diagnosis of laryngeal trauma because severe internal injury may have minor symptoms (1-5).

Endoscopy is superior to CT in the estimation of mucosal or vocal cord changes. Any patient who has evidence of laryngeal trauma based on examination findings should undergo CT imaging of the larynx, if stable. Multidetector computed tomography, with coronal and sagittal reformatted images is extremely helpful for early diagnosis of the laryngeal cartilage fractures. We can also evaluate the cervical spine and vascular injuries.

Fractures appear as discontinuities of the cartilage, with or without displacement, on thin slice and contrast enhanced CT. Reviewing both bone and soft tissue windows is important because soft tissue windows are helpful for poorly ossified cartilage fractures (1).

Laryngeal cartilage has a typically three-layer appearance: high signal bone marrow being surrounded by low signal cortical rims on MRI. It should be performed in patients that have a suspected fracture that could not be seen by CT. Fracture of the non-calcified cartilage, seen in pediatric patients, and soft tissue trauma are better evaluated with MRI. However, it is slower than CT and therefore motion artifacts from breathing, carotid artery pulsation and swallowing may degrade images.

Laryngeal trauma is classified as a group 1 minor hematoma, no fracture; group 2 non displaced fracture; group 3 stable displaced fracture, group 4 unstable displaced fracture and group 5 laryngotracheal disinsertion (1, 3-5). According to this classification, Group 1 and 2 were treated with conservatively while others required tracheotomy and surgery (3, 4). With significant advances in direct fibreoptic laryngoscopy, accurate assessment of rima glottis and serial examinations can be done (2). Our patient had a displaced cricoid fracture on CT but direct fibreoptic laryngoscopy revealed mobile

Figure 4. Axial T1 weighted images show (a) multiple minimally displaced cricoid cartilage fracture (arrows), (b) a non displaced linear thyroid cartilage fracture (arrow) and cricothyroid joint dislocation (double ended arrow) as well as soft tissue hematoma on the left. (c) On fat suppressed T2 weighted images, the edema and hemorrhage of the laryngeal mucosa and subcutaneous fat is evident.
vocal cords with adequate opening of the rima. He was treated conservatively with a successful outcome.

Laryngeal trauma is commonly associated with hyoid fractures. Fractures are usually located at the body of hyoid bone. The synchondrosis between the greater horn and the body of hyoid bone is seen as a vertical radiolucent line, which may be mistaken for a fracture. It is a normal feature in many hyoid bones, especially in the younger age group. In the older age group especially when there is a unilateral nonfusion, it can be misinterpreted as a fracture (6, 7).

Conclusion

Laryngeal trauma is a rare condition and a high degree of suspicion is the most important factor for diagnosis. After clinical examination, CT imaging should be obtained for evaluation of the cartilage fractures and dislocation. MR imaging is useful for demonstrating the non-ossified cartilage fracture, soft tissue edema and hemorrhage. Serial monitoring of the clinical symptoms and airway patency by direct fibreoptic laryngoscopic examination is the choice of treatment in stable patients. Laryngeal fractures are usually associated with hyoid fracture. The synchondrosis of the hyoid bone should not be misdiagnosed as a fracture.

Conflict of Interest

No conflict of interest was declared by the authors.

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Informed Consent: Written informed consent was obtained from patients who participated in this case.

Author Contributions


References