Gunshot wound to the neck with fractured larynx cartilage – restoration of organ function

Rana postrzałowa szyi ze złamaniem chrząstki krtani – przywrócenie funkcji narządu

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Abstract

External blunt or penetrating laryngeal traumas with larynx cartilaginous framework fractures are a rare type of injury because the larynx is well protected by surrounding structures. We report the case of a 58-year-old female teacher with a gunshot wound to the neck and a multi-fragmentation fracture of the thyroid cartilage. The technique used in emergency surgery to restore the larynx, methods of maintaining airway patency and treatment in larynx injuries are presented. If surgery is conducted on time the anatomy of the larynx can be successfully restored, and it is possible to achieve good functional outcomes.

Key words: *larynx, injury, larynx fracture, gunshot.*

Streszczenie

Zewnętrzne tępe i penetrujące urazy krtani z uszkodzeniem jej szkieletu chrzęstnego należą do rzadkości, ponieważ krtań jest dobrze chroniona przez otaczające struktury. W niniejszej pracy przedstawiono przypadek 58-letniej nauczycielki z raną postrzałową na szyi i wielofragmentowym złamaniem chrząstki tarczowatej krtani. Ponadto opisano technikę odtworzenia krtani stosowaną w nagłych przypadkach oraz metody utrzymania pasażu powietrza i postępowania w urazach krtani. Operacja wykonana w krótkim czasie po urazie umożliwia odtworzenie anatomii krtani i uzyskanie dobrych wyników funkcjonalnych.

Słowa kluczowe: *krtań, uraz, złamanie chrząstek krtani, postrzał.*

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Introduction

External laryngeal trauma, blunt or penetrating, is a rare but potentially life-threatening injury [1] that occurs approximately in 1 : 30,000 emergency department visits [2, 3]. The main reason for the rarity of this kind of injury is that the larynx is well protected superiorly by the mandible, inferiorly by the sternum and posteriorly by the cervical spine. Laryngeal framework fractures are extremely rare, and are mostly caused by the direct trauma of the anterior surface of the neck. The mortality rate in blunt trauma has been reported to be higher than 40%, whereas that for penetrating injuries has been reported to be lower than 20% [2]. The majority of traumas are the result of a motor vehicle accident or clothesline injuries. A small percentage of causes include direct blows sustained during assaults, sports injuries, hanging, manual strangulation, and iatrogenic causes. In the literature, management of blunt

or "clothes line" injuries to the airway has been described, but trauma to the airway is not as well defined [1]. We would like to present a patient accidentally shot with a hunting weapon. She suffered a neck injury and a multi-fragmentation fracture of the laryngeal cartilage framework.

Case report

A 58-year-old female teacher was admitted to the Otolaryngology University Department tertiary referral center 4 h after she was shot in the neck. She was transported 60 km from a rural area with mild dyspnea. After the phone consultation between the local anesthetist and ear, nose and throat specialist, intubation was not performed. Such a decision was made because the patient was breathing competently, difficulties in intubation (potential, anticipated difficulties) were feared, and there was no specialist present who could handle the emergency tracheotomy.

On admission, the patient's general condition was good with mild, but slowly exacerbating dyspnea. A slightly extended contour of the neck, a small discrete entry wound in the right submandibular region and outlet at the left site were visible. In palpation, the neck was soft. Indirect laryngoscopy revealed bilateral edema of arytenoids and vestibular folds; the left side of the glottis was not apparent by swelling. The left vocal fold was mobile, but the right side's mobility was limited. Computed tomography (CT) scanning of the larynx showed a fracture of the right lamina of the thyroid cartilage (Figure 1). Based on clinical symptoms and findings in the imaging, the emergency surgery was undertaken. The patient was intubated trans-nasally. The neck was opened with a U-shaped incision, and inspection and lavage of the wound were performed. Disrupted and torn submandibular glands were sutured. The larynx box was exposed (Figure 2). We dissected the torn outer perichondrium, removed the loose piece of cartilage, and fixed the inner perichondrium and inlet mucosa with 6.0 Vicryl sutures. Remnants of the right thyroid cartilage lamina were sutured laterally to the preserved cartilages (cricoid ring, epiglottis and left thyroid lamina with 3-0 Vicryl). The postoperative course was uncomplicated. The intubation tube and nasogastric tube were maintained for 5 and 7 days, respectively. The endotracheal tube secured the airway and served as a stabilizer. After extubation, the airway passage was satisfactory, with a wide air passage: a tracheotomy was not necessary. The patient was discharged after 10 days. At the follow-up visit after 1 month, she had no complaints and breathed freely; however, her neck was still swollen and stiff. Her voice was weak and not particularly sonorous. The left vocal cord had full mobility, and the right had partial mobility, with glottis disclosure in indirect and direct laryngoscopy. After 3 months, the phoniatric examination revealed that the vocal folds were functioning properly. In the patient's opinion, her voice was almost the same as before the accident. The patient resumed teaching after 4 months.

Discussion

Gunshot injuries to the neck are associated with high morbidity and mortality due to the complex anatomy and location of numerous vital structures in this region. The degree of injury depends on the deposited energy, weight, shape of the bullet, and the firing range. Usually, the zone of internal injury is much larger than anticipated at the initial clinical evaluation [3]. It is an undoubtedly uncommon situation when the bullet passes through the neck

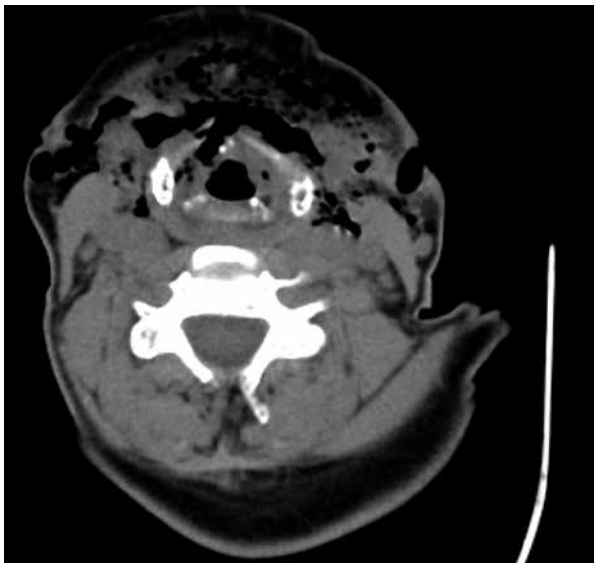

Figure 1. Preoperative computed tomography scan of the larynx

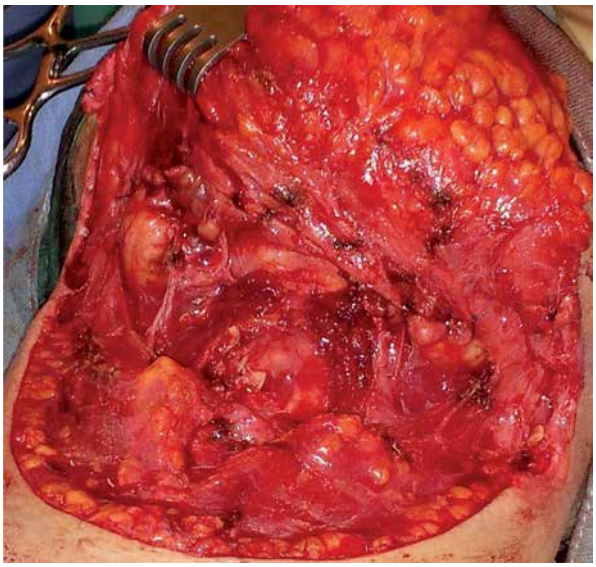

Figure 2. Intraoperative image of fractured thyroid lamina

and does not impair any vital structures in this region: very few of these cases can be found in the literature [4]. We presented a gunshot injury of the neck with a small bullet caliber. The entry wound was in the right submandibular region, the direction of the bullet was lateral and the outlet was on the left side of the neck at a similar level, 3 cm under the mastoid tip. Thus, the trajectory was quite superficial and curved due to the reflection of the cartilaginous framework of the larynx box.

There is a wide range of symptoms presented by patients with laryngeal trauma. The most common are hoarseness, aphonia, dyspnea and stridor; however, hemoptysis, dysphagia, odynophagia, subcutaneous emphysema, loss of laryngeal protuberance and cervical pain and tenderness can also be observed [5]. The presented patient did not display any symptoms except mild dyspnea with a surprisingly good general condition, probably because of the small bullet caliber, superficial trajectory and dissipation of energy by reflection from the larynx box.

Many different diagnostic methods can be used to determine the extent of the laryngeal damage. Scans of the cervical region are especially useful during management of patients with 'clothesline' or blunt injuries to rule out damage to the spine [4, 5]. In the present case, the laryngoscopic examination and CT scan of the larynx provided enough detail for the decision regarding surgical repair of the cartilage skeleton. According to Schaefer [1], a CT scan of the neck is considered the gold standard for diagnosing this type of injury.

Immediate intensive care is critical for the prevention of laryngeal edema and maintaining airway patency. Larynx injuries pose unique challenges, in particular, in the selection of management methods. According to Schaefer [1] and Butler *et al.* [6], intubation and tracheostomy are recommended to rescue the airway in larynx injuries. Endotracheal intubation was associated with many difficulties: changed anatomy, bad visualization, displacement of the arytenoid cartilage and laceration of injured laryngeal tissues. On the other hand, if the procedure is undertaken at an experienced emergency center or in patients without pronounced changes in laryngoscopy, transoral flexible fiber optic laryngoscope intubation is the best method [2]. However, Mendelsohn *et al.* [7] recommended an obligatory tracheostomy within 24 h to secure the airway. The present patient was classified in group III according to the Schaefer-Fuhrman laryngeal trauma classification, and therefore we attempted trans-nasal intubation with a fiber optic laryngoscope as the first step in airway management.

Quick imaging of the cartilage fractures and specialist consultation enable the optimal decision: to conduct conservative treatment or to plan emergency surgery. Even when the airway is secured by intubation or tracheostomy, the larynx (in selected cases of multi-fraction complex fractures) should be restored surgically due to improved functional outcomes. In the present case, the slightly expressed symptoms and constantly visible laryngeal passage could suggest the conservative approach. Probably, the larynx would be healed, but the functional outcome would be very uncertain. Although it was the first case of gunshot trauma in our department, based on past experience in open larynx surgery, we decided to piece together the fragments of cartilage. In addition, according to Butler *et al.*, earlier treatment of injuries of the larynx achieved better voice outcomes [7]. We can confirm this observation; the repair of the laryngeal framework was beneficial for the restoration of anatomy, breathing, swallowing and voice. In this particular case, a return to gainful employment as a teacher was feasible.

Conclusions

For the selected cases of larynx framework fractures, open surgery with cartilage fixation performed within 24 h in a tertiary referral center is beneficial for good functional outcomes. Prolonged trans-nasal intubation with a tube serving as a stabilizer allows us to avoid a tracheotomy or Montgomery T-tube insertion. Voice rehabilitation is indispensable immediately after the first phase of healing.

Conflict of interest

The authors declare no conflict of interest.

References

1. Schaefer SD. The acute management of external laryngeal trauma. A 27-year experience. Arch Otolaryngol Head Neck Surg 1992; 118: 598-604.
2. Kim JP, Cho SJ, Son HY, et al. Analysis of clinical feature and management of laryngeal fracture: recent 22 case review. Yonsei Med J 2012; 53: 992-8.
3. Becker M, Leuchter I, Platon A, et al. Imaging of laryngeal trauma. Eur J Radiol 2014; 83: 142-54.
4. Godhi S, Mittal GS, Kukreja P. Gunshot injury in the neck with an atypical bullet trajectory. J Maxillofac Oral Surg 2011; 10: 80-4.
5. Kohli A, Bhadoria P, Bhalotra A, et al. An unusual laryngeal injury. Indian J Anaesth 2007; 51: 57-9.
6. Butler AP, Wood BP, O'Rourke AK, Porubsky ES. Acute external laryngeal trauma: experience with 112 patients. Ann Otol Rhinol Laryngol 2005; 114: 361-8.
7. Mendelsohn AH, Sidell DR, Berke GS, John MS. Optimal timing of surgical intervention following adult laryngeal trauma. Laryngoscope 2011; 121: 2122-7.

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