

Laryngeal dislocation after ventral fusion of the cervical spine

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ABSTRACT

We report on a 70-year-old patient who underwent ventral fusion of the cervical spine (C3/4 and C4/5) for spinal canal stenosis performed by the neurosurgery department. The patient suffered an exceedingly rare complication of the surgery – laryngeal dislocation. Had the deformed laryngeal structures been overlooked and the patient extubated as usual after surgery, reintubation would have been impossible due to the associated swelling, which might have had disastrous consequences. Leftward dislocation of the larynx became apparent post-operatively, but prior to extubation. Extubation was therefore postponed and a subsequent computed tomography (CT) scan revealed entrapment of laryngeal structures within the osteosynthesis. A trial of repositioning using microlaryngoscopy performed by otolaryngology (ears, nose and throat) specialists failed, making open surgical revision necessary. At surgery, the entrapped laryngeal tissue was successfully mobilised. Laryngeal oedema developed despite prompt repositioning; thus, necessitating tracheotomy and long-term ventilation. Laryngeal dislocation may be an unusual cause of post-operative neck swelling after anterior cervical spine surgery and should be considered in the differential diagnosis if surgical site haematoma and other causes have been ruled out. Imaging studies including CT of the neck may be needed before extubation to confirm the suspicion and should be promptly obtained to facilitate specific treatment.

Key words: Hyoid bone, laryngeal dislocation, oedema, tracheotomy, ventral cervical fusion

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INTRODUCTION

Laryngeal dislocation is a never before described complication after ventral cervical fusion and osteosynthetic stabilization. Intra-operative laryngeal manipulation leading to dislocation can be life-threatening for the patient because of the resultant substantial change to the upper airway anatomy. Furthermore, reactive oedema of the mucous membranes can result. The usual tools for managing difficult airways such as laryngeal mask airways, Fastrach™, video laryngoscopy and coniotomy may fail to establish an airway in such cases.

CASE REPORT

A 70-year-old patient presented to our neurosurgical department with hypoesthesia in the fingers of each

hand, proximal paresis of both legs (motor strength 2/5), pronounced dysfunction of gait and standing as well as recent-onset bladder incontinence. Magnetic resonance imaging showed significant spinal canal stenoses at the levels of C3/4 and C4/5 thus establishing the surgical indication for ventral fusion.

The patient's past medical history included rheumatoid arthritis, asthma and osteoporosis. There were no pertinent findings on physical examination and no laboratory abnormalities found during pre-anaesthetic evaluation.

Ventral fusion and osteosynthetic stabilization were undertaken the following day under general anaesthesia. Induction of anaesthesia was performed using 200 mg propofol and 30 mcg sufentanil followed by total intravenous anaesthesia by continuous

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infusion of propofol (5 mg/kg/h to 8 mg/kg/h) by syringe pump and intermittent injections of sufentanil. Mask ventilation was uncomplicated and 40 mg of the muscle relaxant rocuronium was administered. During direct laryngoscopy oral intubation succeeded atraumatically and with visual confirmation (Cormack–Lehane grade 1) on the first attempt. The oropharyngeal anatomy was unremarkable. The intra-operative course of general anaesthesia was also unremarkable. The tracheal tube cuff pressure was measured continuously. Continuous intra-operative cuff pressure measurements only briefly approached critical values at 40 mmHg at the beginning of surgery resulting from spreading of tissues especially during splitting of the sternocleidomastoid muscle compartment and lateral displacement of carotid sheath.

During the further procedure, especially during microdiscectomy, polyetheretherketone (PEEK) cage fusion and osteosynthetic stabilisation, cuff pressure was not increased.

Hyoid bone appeared unusually large. Otherwise there was no other significant surgical observation that could have led to laryngeal dislocation. The total operating time was 195 min.

Post-operatively, after removal of the drapes, swelling of the left side of the throat became evident. The initial suspicion was a surgery-induced hematoma, but laryngeal structures could be clearly palpated within the swelling, such that intra-operative dislocation of the larynx was probable. Extubation was therefore postponed and a computed tomography (CT) scan was performed subsequently.

The cervical spine CT scan [Figure 1] and 3D reconstruction [Figure 2] showed fixation of the right dorsal portion of the overly elongated hyoid bone and the right superior horn of the thyroid cartilage leftward and behind the osteosynthesis plate. This resulted in a leftward dislocation of the entire larynx [Figures 1 and 2]. Furthermore a large hematoma was ruled out as a cause of swelling in CT scan.

The patient was subsequently transferred to the neurosurgical intensive care unit and referred for Otolaryngology opinion on the same day. After failure of an attempt at endolaryngeal repositioning using microlaryngoscopy under constant readiness to perform a tracheotomy, the ENT colleagues established the indication to perform open repositioning for

the next day. After reopening the wound to its full depth, the hyoid bone spontaneously released from entrapment under the edge of the osteosynthesis plate. The subsequently performed CT scan [Figure 3]

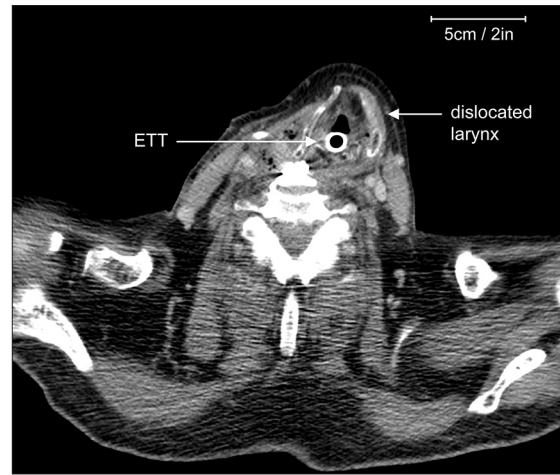


Figure 1: Contrast computed tomography of the cervical spine (post-operative)

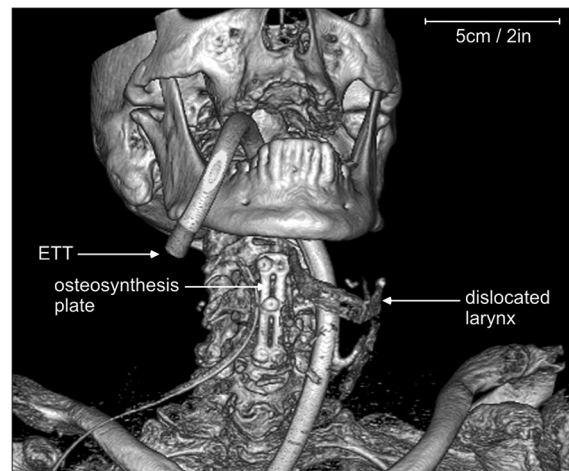


Figure 2: 3D reconstruction of cervical spine and head

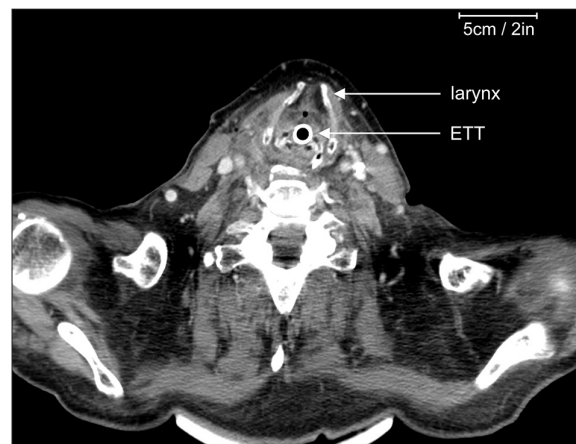


Figure 3: Contrast computed tomography of the cervical spine after open repositioning

showed a normal position of the laryngeal cartilage but also substantial oedema that had formed in the interim. Mucous membranes tightly surrounded the endotracheal tube, and therefore the patient was not extubated and anti-oedema therapy with dexamethasone ($3 \times 4\text{mg}$) for 3 days was initiated.

On the sixth post-operative day, the cooperative and sufficiently spontaneously breathing patient could be extubated. However, the patient suffered respiratory insufficiency after several hours. Reintubation became necessary because of the patient's increasing respiratory insufficiency, bilateral pleural effusions (most likely parapneumonic) and decreasing level of consciousness under non-invasive ventilation. Oral reintubation and oropharyngeal anatomy were unremarkable.

Conventional open tracheotomy was performed by the Department of Otolaryngology on the 12th post-operative day.

During the patient's further clinical course, he unfortunately became septic most likely as a result of a ventilator-associated pneumonia, but responded well to antibiotic therapy. After reducing the level of sedation, the patient still exhibited a significantly decreased level of consciousness. Unfortunately, neurological improvement was slow to progress resulting in the patient only being discharged into neurological early rehabilitation on the 29th post-operative day. Upon transfer from our facility, the patient was awake and oriented, and followed simple commands and could breathe using the T-piece.

DISCUSSION

The case described here is an exceedingly rare complication of a ventral cervical fusion, which has thus far not been described in the literature and resulted in a very adverse outcome for the patient. Despite repositioning of the dislocated larynx, oedema of the mucous membranes formed, which made extubation impossible.

The literature contains references to injuries to the cricoarytenoid as a result of traumatic intubation and arytenoid cartilage dislocation after cardiac surgery or blunt trauma however there are no references to fixation of laryngeal tissues to osteosynthetic materials.^[1-3]

Injuries to the esophagus, trachea and larynx are discussed as extremely rare complications at the time informed consent is obtained at our neurosurgical

department. These however are largely consequences of the ventral approach, and are not expected to be caused by the osteosynthesis material itself.

Fountas *et al.* analysed complications of anterior cervical discectomy and fusion in 1015 patients in a retrospective study.^[4] Tracheal and esophageal perforations were also described along with dysphagia, hematoma and paralysis of laryngeal nerves. One case was also described in which an osteosynthesis screw loosened after 16 months.

Furthermore, there are a multitude of case reports on complications from ventral cervical surgery including examples such as a case of compression of the upper airway by post-operative haemorrhage into the soft-tissues of the neck, an intramural cricopharyngeal hematoma, persistent dysphagia, a case of esophageal perforation and a case of pharyngeal esophageal perforation after seven postoperative years.^[5-9]

The continuous intra-operative monitoring of endotracheal tube cuff pressure is standard at our hospital in ventral cervical fusion surgery to prevent increased pressure on the tracheal tissue and thus reduce the risk of tracheomalacia. In this case, the maximal pressure of 40 mmHg only reached borderline critical values briefly. These are most likely to have occurred at the beginning of surgery resulting from spreading of tissues at the surgical site. Otherwise, all cuff pressure readings during this surgery were normal (20 mmHg).^[10] Therefore, cuff pressure monitoring is not suited for detecting this sort of dislocation.

On closer inspection of the anatomic structures an abnormally large hyoid bone was found. It is likely that this anatomic anomaly enabled the osteosynthesis plate to get caught behind the hyoid bone. So far no comparable case has been described in the literature. Thus, it is important to examine neighbouring structures to the osteosynthesis area before and after bringing in the osteosynthesis material.

This case report further demonstrates the importance of examination of neck and surgical site before extubation.

It is likely that after extubation, the required mask ventilation and reintubation would have been exceedingly difficult. Besides a further necessary intervention such as coniotomy have been challenging by the anatomical changes caused by the dislocation.^[11]

CONCLUSION

Laryngeal dislocation is a never before described complication after ventral cervical fusion.

Intraoperative laryngeal manipulation leading to dislocation can be life-threatening for the patient because of the resulting substantial change to the upper airway anatomy. Furthermore, reactive oedema of the mucous membranes can result.

The case report shows the importance of examination of neck and surgical site before extubation. It is to be assumed that the airway management of patients with laryngeal dislocation is difficult.

In cases where post-operative changes to the airway are suspected, the patient should not be extubated and imaging promptly obtained. A rapid and interdisciplinary course of action is vitally necessary in such situations.

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