

Upper airway obstruction associated with flexed cervical position after posterior occipitocervical fusion

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Abstract Upper airway obstruction resulting from overflexion fixation of the cervical spine is a rare but life-threatening complication after cervical spine surgery. There are few reports of dyspnea after a posterior cervical fusion. We present the case of a 63-year-old woman with rheumatoid arthritis who developed an upper airway obstruction immediately after an O–C4 fusion. She was reintubated with a fiberoptic scope. Revision surgery allowing the angle to return to the neutral position was performed to ameliorate the overflexion of the cervical spine fixation and the consequent upper airway obstruction. After revision surgery, the upper airway obstruction disappeared. Our experience suggests that intraoperative use of fluoroscopy and extubation with a tube exchanger are recommended to avoid this complication, especially in patients at high risk of upper airway obstruction.

Keywords Rheumatoid arthritis · Airway obstruction · Spinal fusion

Introduction

Upper airway obstruction is not uncommon after cervical spine surgery. The most common cause of this complication is pharyngeal edema [1–6]. However, it is not widely known that a cervical fusion in a flexed position may cause upper airway obstruction. There are only a limited number of reports describing the issue [1, 2]. This is a case report of upper airway obstruction after posterior occipitocervical fusion in a patient with rheumatoid arthritis. Intraoperative management and extubation strategy for use in such situations are discussed.

Case report

A 63-year-old woman had suffered from rheumatoid arthritis for 23 years and had undergone C1–C2 fusion for atlantoaxial subluxation 2 years previously. She presented complaining of numbness in all extremities and occipital pain. Radiographs of the cervical spine revealed instability at C1–C2. To treat this, a posterior fusion from occipital bone to the fourth cervical vertebra (O–C4) was performed.

General anesthesia was induced with remifentanyl 50 µg, propofol 70 mg, and after confirmation of adequate facemask ventilation, rocuronium 25 mg was given for muscle relaxation. She was smoothly intubated with a standard, cuffed 7.0-mm tracheal tube using a conventional Macintosh laryngoscope. General anesthesia was maintained with sevoflurane and remifentanyl. The operation was performed uneventfully via posterior approach in the prone position. The operation time was 5 h 31 min, with an estimated blood loss of 470 ml.

Although extubation was performed under adequate spontaneous breathing, the patient suffocated immediately

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upon retraction, and subsequently oxygen desaturation was noted even on complete recovery of consciousness. Awake reintubation with a laryngoscope failed because of restriction of mouth opening caused by short jaw to chest distance, rigid neck, and the flexed cervical angle after cervical spinal fusion. Oxygen supply via a facemask was enabled by inserting a nasal airway and protruding the mandible anteriorly. Oxygen saturation quickly improved and was maintained at a level greater than 98%. Awake nasotracheal intubation with the same tracheal tube using a 5.5-mm fiberoptic scope was performed successfully, although the pharyngeal space was reduced. Postoperative lateral cervical radiograph (Fig. 1b,c) showed no increased thickening of the pharyngeal wall compared to that of the preoperative radiograph (Fig. 1a), and her face and neck were not edematous. Therefore, although pharyngeal edema could not be ruled out, the most probable cause of her upper airway obstruction was overflexion fixation of the cervical spine.

Revision surgery allowing the occipitocervical alignment to return to the neutral position was carried out 3 h after the first surgery. At that time, the fixation angle of the cervical spine was adjusted and sufficient pharyngeal space was confirmed by fluoroscopic guidance during the operation. Because of the presence of pharyngeal edema, she was extubated, with a tube exchanger left in place as a precaution against possible reintubation. However, it was possible to remove the exchanger in 5 min because spontaneous breathing and oxygenation of the patient remained adequate. No airway obstruction appeared after the revision surgery. One month later, she was discharged without neurological sequelae, and had not experienced difficulty in breathing.

Discussion

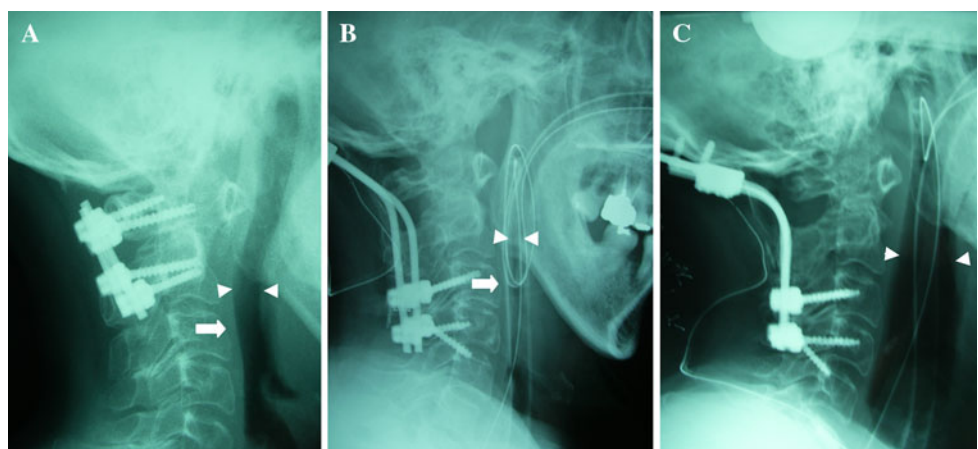
Upper airway obstruction resulting from overflexion fixation of the cervical spine is a rare but life-threatening

complication after cervical spine surgery. To the best of our knowledge, there have been only two reports in the international literature addressing this issue [1, 2]. Potential causes of airway obstruction in cervical spine surgery or injury include pharyngeal edema [1–6], hematoma [7, 8], cerebrospinal fluid leak [4, 9], angioedema [10], graft or plate dislodgement [11, 12], recurrent laryngeal nerve injury [13], and overflexion fixation of the cervical spine [1, 2, 14]. The most common cause is pharyngeal edema [15].

Postoperatively, the patient suffocated immediately after extubation, not in the presence of fiberoptic and radiographic findings of pharyngeal edema but in the presence of preoperatively unrecognized signs of restricted mouth opening, short jaw to chest distance, rigid neck, and the flexed cervical angle. In addition, a radiograph demonstrated an evident narrowing of the upper airway, although fortunately her suffocation could be successfully treated with insertion of a nasal airway and anterior protrusion of the mandible. After the revision surgery, she did not develop any upper airway obstruction despite the presence of some pharyngeal edema. Further, a radiograph demonstrated marked improvement in the narrowing of the upper airway. Therefore, our experience clearly indicated that the upper airway obstruction after spinal fusion surgery was primarily caused by cervical malalignment from overflexion fixation of the cervical spine.

Although the symptom was relieved by conservative treatment without changing the fixation angle in one previous case [1], another case [2] shows that, despite the presence of pharyngeal edema, the upper airway obstruction improved after the occipitocervical alignment was changed from a flexed to the neutral position, as in our patient. We believe this change played a major role in the patient's respiratory improvement after extubation. However, intraoperative adjustment of the fixation angle of the cervical spine and confirmation of the pharyngeal space by fluoroscopic guidance at the initial surgery might have

Fig. 1 Plain lateral cervical radiographs. **a** Before surgery. **b** After the initial surgery. **c** After revision surgery. The pharyngeal space (*arrowheads*) was reduced after the initial surgery; however, the posterior pharyngeal wall was not thickened (*arrows*). Pharyngeal stenosis disappeared after revision surgery



prevented the initial complication and the need for revision surgery. Without such precautions, we could not anticipate the postoperative development of the airway obstruction, as we did not observe a change in the airway pressure during volume-controlled ventilation, restrictive breathing before extubation, or difficulty in inserting a suction catheter through the tracheal tube during or after surgery. Probably, upper airway patency could not be maintained without a support by a tracheal tube or nasal airway in our case, although the upper airway obstruction was not so severe as to externally compress and occlude the tracheal tube. From our experience, it seemed prudent to extubate the trachea with a tube exchanger left in place as a precaution against possible necessity of reintubation, especially in patients at high risk of airway obstruction, such as patients with some pharyngeal edema, those with rheumatoid arthritis involving the cervical spine, and those following overflexion fixation of the cervical spine. For patients with severe pharyngeal edema, maintaining intubation for several days postoperatively is recommended [1, 15, 16].

Spinal fusion in a flexed position causes the C2 vertebral body to protrude the posterior pharyngeal wall anteriorly, resulting in pharyngeal stenosis [2]. A reduction in the size of the upper airway in patients with rheumatoid arthritis is caused by the relative shortening of the cervical column [17], temporomandibular joint destruction [18], and deformities of the larynx [13, 16, 19]. Taking these points into account, rheumatoid arthritis may increase the risk of upper airway obstruction after cervical surgery.

We have presented an unusual case of a patient with rheumatoid arthritis who developed an upper airway obstruction after a posterior occipitocervical fusion. The prime cause of this catastrophic complication was considered to be overflexion fixation of the cervical spine. Intraoperative fluoroscopy for adjustment of the fixation angle and confirmation of pharyngeal space is useful in preventing this complication. The use of a tube exchanger upon extubation may be also a useful adjunct in patients at high risk of upper airway obstruction. Anesthesiologists should be aware that cervical fixation in a flexed position may significantly increase the risk of upper airway obstruction after cervical fusion, especially in patients with rheumatoid arthritis.

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