Chapter

A Case of Endotracheal Tube Damage during Maxillomandibular Osteotomy Found by Bronchofiberscope

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Abstract

We experienced a case of endotracheal tube damage during maxillomandibular osteotomy found by bronchofiberscope. The patient was a 22-year-old man, scheduled for maxillomandibular osteotomy under general anesthesia for the treatment of two jaws deformity. Tracheal intubation of Microcuff subglottic endotracheal tube (I.D.7.5 mm made by Halyard Health Care Inc.) was *via* the left nasal cavity. The surgery started from maxilla and became the maxillary transection approximately 50 min later. There was the indication of the ventilation gas leak from the operation after the maxillary transection, but we confirmed that, and there was no tube in the clear abnormal findings with bronchofiberscope. Because the positive pressure ventilation was possible, and the ventilation had no problem, we decided to resume surgery. After maxillary fixation was completed approximately 3 and a half hours later, and confirming with bronchofiberscope again, we confirmed an inflow of the blood in a tube and confirmed a tube laceration to around 4–5 cm from the nasal cavity entrance. We decided to conduct tube exchange. After the surgery, the cause of tube rupture was examined; it was then found that the tube was damaged by a bone chisel used during maxillary bone dissection. When there is doubt about a endotracheal tube damage, confirmation of the inner surface using a bronchofiberscope is useful, and it is important to grasp the case early.

Keywords: bronchofiberscope, tube rupture, nasotracheal intubation, maxillomandibular osteotomy, general anesthesia

1. Introduction

The damage of the endotracheal tube under general anesthesia causes respiratory failure. It is difficult to check the endotracheal tube in nasotracheal intubation; therefore, the use of the bronchofiberscope is effective.

We experienced a case of endotracheal tube damage that was discovered during maxillamandibular osteotomy by bronchofiberscope, which we have therefore reported.

I obtained consent from the patient concerned to report the present case.

2. Case subject

The patient was a 22-year-old male of 178 cm in height and weighing 85 kg. The patient was diagnosed with maxillamandibular deformity, and for the treatment, maxilla-mandibular osteotomy under general anesthesia was scheduled. There was no particular medical history or family history, and on preoperative examination, there were no particular findings observed.

3. Progress

There was no premedication administered, and the patient was admitted to a hospital in ambulatory condition. Anesthesia was introduced rapidly using remifentanil hydrochloride, propofol, and rocuronium bromide under oxygenation. For the tracheal tube, left-sided nasotracheal intubation was performed using a subglottic endotracheal tube® (Halyard Healthcare Inc.) with inner diameter of 7.5 mm. Cuff inflation was performed using a 5 ml syringe, airway pressure was 20 cm H_2O, and there was no air leak. Anesthesia was maintained with air pressure at 5 l/min, oxygen at 1 l/min, propofol at 4 mg/kg/h, and remifentanil hydrochloride at 0.2 μg/kg/min, and with additional administration of rocuronium bromide as needed.

Surgery was commenced from the upper jaw, and maxillary bone dissection was completed in approximately 50 minutes. After dissection, the surgeon identified a ventilation gas leak. As there was no clear displacement of the tube, endotracheal cuff insufficiency was suspected, and inflation was increased to 7 ml (cuff pressure of 27 cm H_2O). There was no decrease in cuff pressure, and a cuff abnormality was ruled out; however, the ventilation gas leak could not be stopped, and therefore, the tube lumen was verified by bronchofiberscope. However, there were no clear abnormal findings observed. Positive pressure ventilation was possible, and because there was no problem with the ventilation status, maxillary fixation was recommenced. Upon recommencement, ventilation gas leakage was verified again. Maxillary fusion was completed at approximately three and a half hours after verification of the initial leakage, and therefore, upon reverifying with a bronchofiberscope, blood inflow within the tube was confirmed, and tube damage at 4–5 cm from the nasal cavity inlet was confirmed (**Figure 1**). Thus, tube replacement was planned. While expanding the larynx, the damaged tube was removed, and orotracheal intubation was immediately performed. With orotracheal intubation, respiratory intubation was confirmed, a new tube (subglottic endotracheal tube® with inner diameter of 7.5 mm) was carefully inserted by left-sided nasotracheal intubation, and after passing through the nasal cavity, the orotracheal tube was removed, and intubation with the new tube was performed immediately.

After achieving nasotracheal intubation again, the ventilation gas leak disappeared. Thereafter, mandibular osteotomy was commenced and completed with an operative duration of 7 h and 59 min. Intubation upon returning to the wardroom was planned, and therefore, the patient was transferred to his ward under management by propofol at 2–4 mg/kg/h and fentanyl hydrochloride at 20 μg/h, and the duration of anesthesia after stable spontaneous respiration was 9 h and 54 min.

Upon searching for the cause of the tube damage postoperatively, we found that the damage was caused by the bone chisel used for maxillary bone dissection (**Figure 2**).

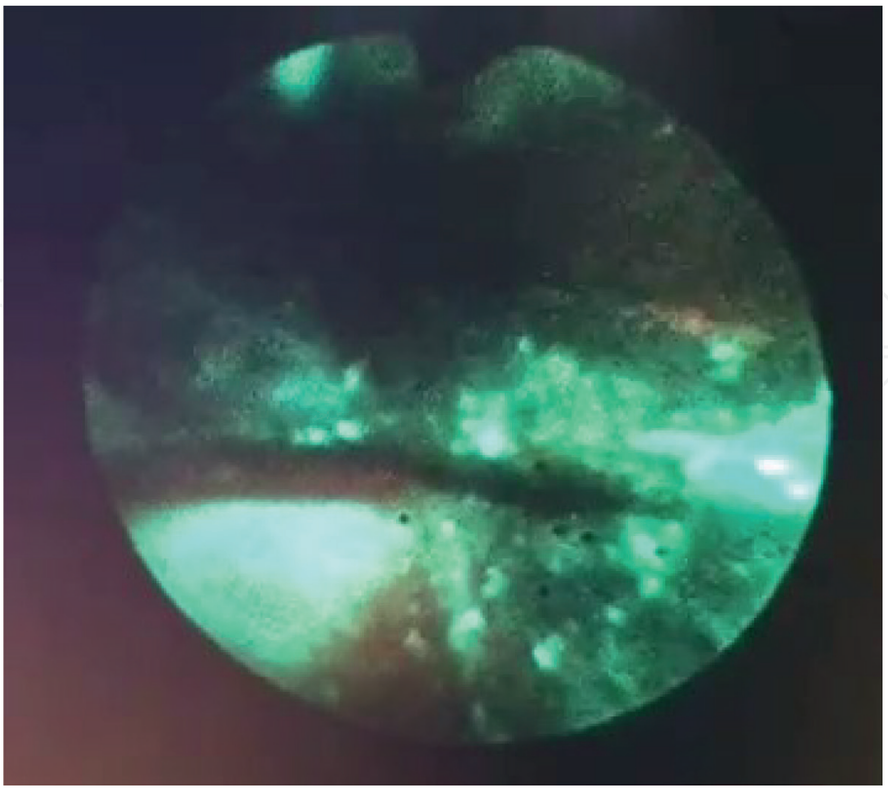

Figure 1.
Endotracheal tube damage found by bronchofiberscope.

4. Discussion

In this case, maxillary osteotomy was performed using the Le Fort I procedure. In the Le Fort procedure, osteotomy is performed from the piriform aperture to the lateral wall of the nasal cavity, anterior wall of the maxillary sinus, maxillary tuberosity, and the pterygomaxillary junction [1]. For this case, we used a reciprocating saw to dissect from the anterior wall to the lateral wall of the maxillary sinus, and used a bone chisel to dissect the junction between the maxilla and the sphenoid bone. In the postoperative verification, the blade shape of the bone chisel was consistent with the tube damage site, and therefore, the damage was judged to have been caused by the bone chisel. It was thought that the damage occurred when dissecting the junction between the maxilla and the sphenoid bone on the left side.

Although a cuff leak was initially suspected intraoperatively, it was judged that there was no decrease in cuff pressure and no cuff abnormality. Therefore, the inner surface of the tube was verified using a bronchofiberscope. With the initial verification, no clear damage could be confirmed, and there was no inflow of blood. The intubation tube that was used in the present case was a Microcuff subglottic endotracheal tube® (Halyard Healthcare Inc.) with an inner diameter of 7.5 mm; however, because suctioning can be performed above the cuff, the external diameter was 11.2 mm and the tube was thick overall. Consequently, time was required for the expansion of the damaged part and until blood inflow, which was thought to explain why there was no clear abnormality observed in the initial verification.

As a result, general anesthesia management was performed for approximately three and a half hours while the tube was damaged; however, in retrospection, it is possible that if the tube had been verified again, then the damage could have been detected

Figure 2.
The cause of tube rupture was damaged by a bone chisel used during maxilliary bone dissection.

earlier. When there is suspicion of endotracheal tube issues, it is important to identify the cause early, such as by verifying the inner surface of the tube once or twice per hour. In this although there was no inflow of blood into the trachea, a large volume of blood inflow as a result of tube damage has been reported [2], and a case of pulmonary collapse presenting with blood inflow has been reported [3], and therefore the risk of pulmonary complications is increased if verification of tube damage is delayed.

Several past reports can be found that describe similar endotracheal tube damage in Le Fort I osteotomy. One of such reports describes treatment by increasing the fraction of inspired oxygen and oxygen flow rate in the circuit [4], while another report describes tube damage repaired with tape and without removing the tube but rather pulling the tube out several centimeters [5]. However, in this case, because intubation upon returning to the wardroom was planned, and that the damage was verified at a point in time before commencing mandibular osteotomy, we chose to perform tube removal and repeat nasotracheal intubation.

With regard to re-intubation, the maxillary surgery was complete and normal expansion of the larynx was possible, and therefore, immediately after removing the damaged tube, orotracheal intubation was performed while performing respiratory management, after which a tube was carefully inserted into the left nasal cavity, and nasotracheal intubation was performed.

Repeat intubation was completed safely using video laryngoscopy and avoiding conventional laryngeal expansion has been reported [6], and it has also been reported that with actual video laryngoscopy, compared to the direct-viewing method, the visual field of the larynx is better, and tube insertion can thus be performed more rapidly and easily [7]. Therefore, the use of video laryngoscopy should probably be considered in situations where it is difficult to expand the larynx. Furthermore, for reliable re-intubation, the use of a tube exchanger should be kept in mind [8]; however, considering that it can be difficult to pass the tube through the nasal cavity immediately after maxillary osteotomy, as in this case, we avoided its usage.

5. Conclusions

We experienced a case in which endotracheal tube damage was detected during maxillamandibular osteotomy by bronchofiberscope. When endotracheal tube damage is suspected, it is useful to verify the inner surface of the tube using a bronchofiberscope, and it is important to identify the cause of the damage early.

Conflict of interest

The author declares no conflict of interest.

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