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Atelectasis and bilateral pneumothorax after bimaxillary orthognathic surgery: A case report and review

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ABSTRACT

Respiratory complications after orthognathic surgery are rare but may be life-threatening. Upper airway impairment, atelectasis, pneumonia, pneumomediastinum, and pneumothorax have been reported. This article reports on a 19-year-old woman suffering from atelectasis, pneumomediastinum and a bilateral pneumothorax after bimaxillary surgery. Possible aetiologies for this cascade of complications are volutrauma and/or air dissecting down the cervical fascial planes. The bilateral pneumothorax is preferably treated with the placement of thoracic drains because of the high early success rates. Orthognathic surgeons should be aware of this potentially life-threatening complication.

1. Introduction

In recent decades, various complications after orthognathic surgery have been described. The most common are infection, temporomandibular joint disorders or impairment, sensory nerve dysfunction, non-union of the osteotomy gap, and skeletal relapse [1,2]. Respiratory complications such as atelectasis, pneumonia, pneumothorax, and pneumomediastinum also exist but are rare; however, they can be life-threatening [3,4].

2. Presentation of case

This case involved a 19-year-old woman without any relevant medical history and in good preoperative condition. She underwent bimaxillary orthognathic surgery because of a hypoplastic mandible resulting in an Angle class II malocclusion with traumatic palatal bite.

As is standard procedure in the hospital, a nasogastric tube was placed, the patient was intubated nasally and one dose of cefazolin was given intravenously. The surgery went well with little blood loss. Postoperatively, firm elastic intermaxillary fixation (IMF) was applied. Despite the uneventful procedure, 15 minutes after extubation, the patient's oxygen saturation dropped to between 77% and 92%. Supplemental oxygen was given. A small, insignificant epistaxis was noticed. Noteworthy, a lot of blood could have been aspirated through the nasogastric tube. After a few minutes, the patient began to spit out and throw up blood. Signs of dysphagia were present. The

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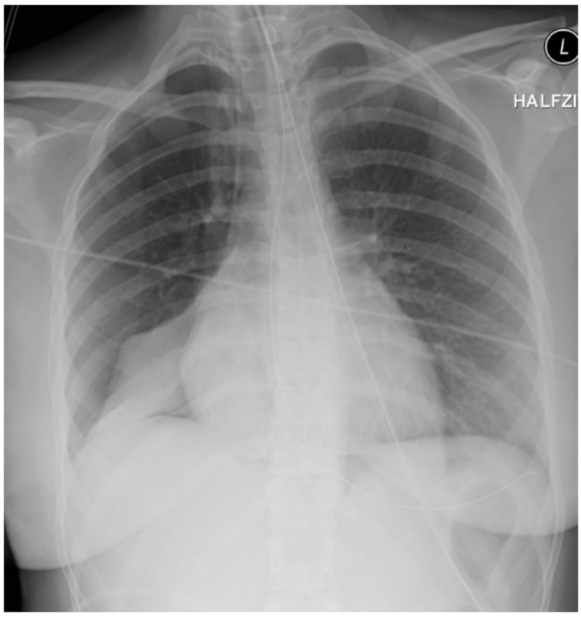

Fig. 1. Chest X-ray 1 hour and 30 minutes after extubation (14:51 PM); atelectasis ofthe right lower lobe.

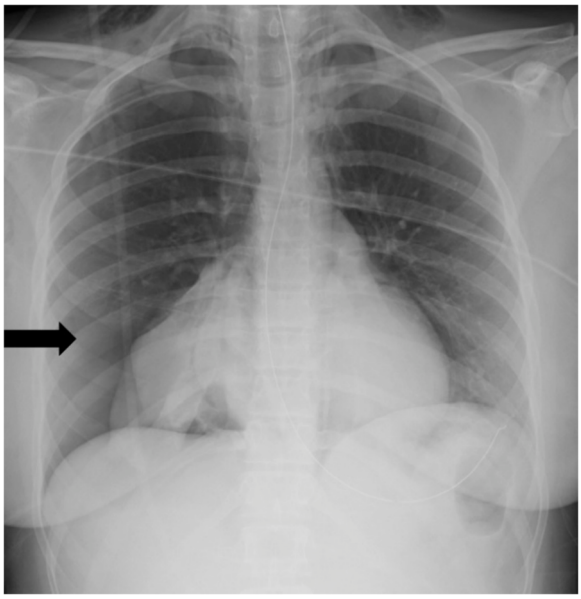

Fig. 2. Chest X-ray 3 hours after extubation (16:15 PM); right pneumothorax and atelectasisof the right lower lobe and subcutaneous emphysema of the neck, right axilla, and upper mediastinum.

IMF was cut and she began to drool.

A chest X-ray was performed 45 minutes after extubation and showed infiltration of the right lower lobe. Manual ventilation with a Waters set balloon with a half-open valve (30 mm H_2O) and 60% oxygen was started. Under this treatment, the saturation rose to 92%. Less than one hour later, it dropped again to 77%. A second X-ray showed an atelectasis of the right lower lobe (Fig. 1). A Non-Invasive Ventilation (NIV) full face mask was placed for further ventilation. Saturation remained low, and a control chest X-ray 3 hours after extubation showed a right pneumothorax and subcutaneous emphysema of the neck, right axilla, and upper mediastinum (Fig. 2). 30 minutes later, a thoracic drain was placed, but the saturation remained between 81% and 85%.

Eventually, the decision was made to reintubate the patient and transfer her to the intensive care unit (ICU). There she was linked to a Servo-I respiratory machine with peak pressure of around 30 cm H_2O. Saturation rose to 92%. A new chest X-ray 2 hours afterwards showed a left pneumothorax (Fig. 3). This was also treated with the placement of a thoracic drain.

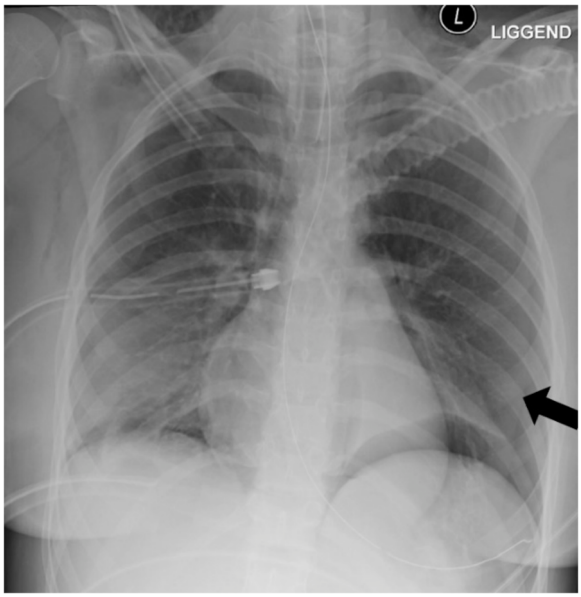

Fig. 3. Chest X-ray 7 hours after extubation and 2 hours after reintubation (20:22 PM);new pneumothorax on the left side.

One day after surgery, a test extubation and bronchoscopy was performed, which showed no leaks of the trachea. However, a big blood clot was aspirated from the left lung. Because of the remaining left pneumothorax 2 days after surgery, a second thoracic drain was placed, which led to resolution of the left pneumothorax.

Ultimately, the patient was admitted in the ICU for 5 days. Four days afterwards, she could go home without residual symptoms.

3. Discussion

The differential diagnosis of postoperative hypoxemia can be divided into early (first 1–2 hours) and late hypoxemia (12–24 hours postoperatively). Early hypoxemia, as in our case, is most commonly caused by upper airway obstruction, drug-induced respiratory depression, or atelectasis [5]. Atelectasis is a loss of lung volume with reduced inflation of a segment or lobe. The most common cause is bronchial obstruction. Post-operative atelectasis is often benign and easily reversible after ventilation with supplemental oxygen. It can, however, lead to a decreased oxygen exchange, resulting in hypoxemia [6].

When air is present in the pleural space, it is called a pneumothorax [7]. The two main mechanisms by which a secondary pneumothorax can develop are:

1. Traumatic disruption of the chest wall or cervical fascia.
2. Alveolar rupture due to increased intra-alveolar pressure (pressure trauma or volutrauma) [4,8]. When ventilation is performed or when the patient chokes or coughs in the presence of a bronchial obstruction, alveolar pressure can rise, which can result in rupture of the alveoli [8,9].

In our case, we speculate that the patient aspirated blood and secretions, causing a bronchial obstruction. She was probably predisposed to aspiration because of her postextubation dysphagia. Multiple factors may have been involved in her dysphagia. First, the nasogastric tube could have caused pain. Secondly, the patient did not cough during extubation which could indicate that she didn't regain complete consciousness [10,11].

The bronchial obstruction most likely caused the atelectasis. To treat this atelectasis, the patient was manually ventilated. This in turn could have led to air entrapment, causing the pneumothorax (volutrauma). It is also possible that during ventilation, air dissected through the intra-oral dissection planes, to the cervical fascia, the mediastinum and eventually, the pleural space. The presence of emphysema of the neck, right axilla, and upper mediastinum supports this last assumption [12,13].

Another possibility is that a tracheal trauma caused the pneumothorax. Despite a normal bronchoscopy this could not be excluded.

It could be questioned if reintubating the patient was necessary. This might have caused the left pneumothorax, especially because high peak pressure was applied.

Remarkably, most of the cases with pneumothorax, pneumomediastinum, and atelectasis after orthognathic surgery found in literature occurred more than 12 hours after surgery (Table 1). The most common cause seems to have been volutrauma. There was one other case where a pneumothorax occurred within 12 hours after surgery. In that report, the pneumothorax was probably caused by the CPAP [12].

Table 1
Comparison with other case reports.

	TYPE OF SURGERY	PNEUMOTHORAX	PNEUMO-MEDIASTINUM	ATELECTASIS	MOST LIKELY CAUSE	TIME AFTER SURGERY
Edwards et al. (1986) [9]	Le Fort I	Left	Yes	Yes	Volutrauma	14 hours
Edwards et al. (1986) [9]	Bimax	Left	Yes	Yes	Volutrauma OR air dissecting down the fascial planes	1 day
St-Hilaire et al. (2004) [13]	Bimax	No	Yes	Yes	Volutrauma	12 hours
Aziz et al. (2010) [6]	Bimax	No	No	Yes	Lobar obstruction	<1 hour
Kim et al. (2010) [8]	BSSO	Right	Yes	Yes	Lobar obstruction	3 days
Chebel et al. (2010) [12]	Le Fort I	Bilateral	Yes	Yes	Air dissecting down the fascial planes	<1 hour
Goodson et al. (2010) [14]	Bimax	Left	No	Yes	Volutrauma OR primary spontaneous	2 days
Bertossi et al. (2012) [15]	Bimax	Bilateral	Yes	No	Air dissecting down the fascial planes	1 day
Corega et al. (2014) [4]	Bimax	Bilateral	Yes	Yes	Volutrauma OR lobar obstruction	1 day
Our patient (2017)	Bimax	Bilateral	Yes	Yes	Volutrauma OR air dissecting down the fascial planes	3 hours

Table 2
Suggestions on risk management [2,3,8,17].

Evaluate pre-operative health and make sure no lung infection is present at the moment of surgery.
Minimize intraoperative trauma to avoid excessive bleeding and large intra-oral dissection planes
Limit operation time to avoid atelectasis
Make sure secretions and blood are properly removed
If possible, IMF should not be performed until the patient breathes deeply, coughs, or can swallow OR make sure the IMF can be cut quickly if necessary
Check for epistaxis after nasal intubation
In case of signs of dysphagia, be aware of aspiration and monitor saturation frequently
Try to avoid CPAP

The standard management of atelectasis consists of spirometry and chest physiotherapy. However, after maxillofacial surgery, this treatment is difficult and has an impaired efficacy. If the saturation is less than 90%, supplemental oxygen should be given. Continuous positive airway pressure (CPAP) should be avoided because of the risk of subcutaneous emphysema, pneumomediastinum, and pneumothorax [4,12]. If no clinical improvement has occurred within 24 hours, bronchoscopy is indicated to visualise an obstruction [6].

As standard treatment for an acute pneumothorax, intercostal tube drainage is used. Alternatively, aspiration can be performed, but this is associated with inferior early success rates although with a generally shorter hospital stay. Recurrence rates do not differ between these options [16].

Despite the fact that these severe complications after orthognathic surgery are exceedingly rare, some suggestions on risk management should be considered. These are summarized in Table 2.

4. Conclusion

We present a case with atelectasis, emphysema and a bilateral pneumothorax in a healthy individual after orthognathic surgery. These pulmonary complications after orthognathic surgery are very rare but can be life-threatening. They require swift diagnosis and appropriate treatment.

Ethical approval and informed consent

Not required.

Conflicts of interest

None.

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