

Delayed Airway Obstruction after Craniotomy in the Park-Bench Position: Two Case Reports

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Abstract

The park-bench position is used for patients requiring posterior fossa procedures. Manipulation of the head and neck during positioning can have serious consequences, such as quadriplegia, cerebral infarction, or brachial plexus injury. However, delayed airway obstruction related to the park-bench position has been rarely reported in the medical literature. We report two cases in which the patients experienced delayed unilateral massive swelling of the neck and face after craniotomy in the park-bench position. One of the two patients required emergency endotracheal intubation and subsequent tracheotomy. We performed a literature search and found only seven reported cases in the English literature, including our two cases. All cases were reported from Asian countries; India, Japan and Taiwan. Four reports included patient height and weight, with body mass index $\leq 19.2 \text{ kg/m}^2$. To gain optimal surgical access to the posterior fossa, the neck of some patients might be excessively flexed laterally, especially if they are underweight. We warn that hyperflexion of the neck in the park-bench position might cause delayed airway swelling, especially for patients who are underweight.

Keywords: Park-Bench Position, Delayed Airway Obstruction, Neck Swelling, Neck Hyperflexion.

Introduction

Neurosurgical patients require specific positions during surgery, and inadequate patient positioning can lead to serious adverse events and complications. The park-bench position, laterally flexed from the vertical plane with the neck rotated toward the floor in the lateral position, is used for patients requiring posterior fossa procedures. Manipulation of the head and neck during positioning can have serious consequences, such as quadriplegia, cerebral infarction, or brachial plexus injury [1]. However, delayed airway obstruction related to the park-bench position has been rarely reported in the medical literature [2]. We report two cases in which the patients experienced delayed unilateral massive swelling of the neck and face after craniotomy in the park-bench position. One of the two cases required emergency endotracheal intubation and subsequent tracheotomy.

Case report

Case 1

A 29-year-old man had vertigo and nausea for 3 months. He was 170 cm in height and weighed 46 kg (Body mass index (BMI) 15.9 kg/m^2). Computed tomography (CT) of the head revealed a left cerebellopontine angle tumor. A neurological examination showed no abnormalities. His past history was unremarkable. He underwent a resection of the tumor with craniotomy in the right park-bench

position. The pathological diagnosis of the tumor was schwannoma. The duration of the operation was 12 h 38 min. He was transferred to the intensive care unit (ICU) postoperatively, with the endotracheal tube remaining in place due to suspicion of lower cranial nerve palsy associated with the operation.

The patient was extubated 12 h after the operation. Bronchofiberscopy immediately after extubation showed partial paralysis of the left vocal cord. Swelling of the right side of the face and neck was observed 2 h after extubation. The patient complained of mild respiratory distress due to retention of sputum. Right upper extremity weakness developed on post-operative day 2. Right brachial plexus injury was suspected as a cause of the weakness, and the patient was transferred to the medical ward on the same day for further observation. The swelling resolved within 2 weeks, and weakness improved after rehabilitation. The patient was discharged from the hospital on post-operative day 27.

Case 2

A 63-year-old woman had a headache for 9 months. She was 153 cm in height and weighed 45 kg (BMI 19.2 m^2). Magnetic resonance imaging revealed a left acoustic tumor suspected schwannoma. A neurological examination showed slight abnormality of the left auditory nerve. Her past history was unremarkable. Her preoperative laboratory test values, chest X-ray and electrocardiography findings were normal.

The patient underwent resection of the tumor via a left lateral suboccipital craniotomy. After standard monitoring was applied, general anesthesia was induced with target-controlled infusion of propofol and continuous infusion of remifentanyl. Muscle relaxation was achieved with intravenous rocuronium. Successful oral intubation was performed with a 7.0 mm internal diameter reinforced tube using McGRATH MAC® (Covidien, Japan). The endotracheal tube was fixed at a depth of 23 cm without an oral airway or a bite block. No gauze was used to pack the pharynx. The patient was not administered additional muscle relaxants to allow for motor evoked potential monitoring of the facial nerve. She was then placed in the right park-bench position with the neck flexed and rotated using a Mayfield three-point head holder. The operation was performed via a left lateral suboccipital approach. Before opening the dura, 150mL of 20% mannitol was administered. The patient's hemodynamic and respiratory status were stable and no brain swelling was observed throughout the operation. The duration of the operation was 12 h and 28 min. The total infusion volume was 7,400 mL, blood loss was approximately 450 mL and urine output was 4,745 mL. The pathological diagnosis of the tumor was schwannoma. No abnormality of the face and neck except for small skin erosion on the right side of the neck was observed when she was returned to the supine position. She was transferred to the ICU postoperatively with the endotracheal tube remaining in place due to slow awakening from anesthesia.

The patient was extubated 1 h after the operation when she was able to respond to commands and her vital signs were within normal ranges. She gradually developed stridor after extubation, and airway obstruction worsened markedly. She underwent emergency reintubation due to airway obstruction 1 h after extubation. Right upper extremity weakness was observed 10 h after the operation. A second extubation was attempted 11 h after the operation because full cuff leak was observed. Soon after extubation she developed marked stridor again and complained of respiratory distress. Although noninvasive positive-pressure ventilation was attempted, her respiratory distress was not improved. Swelling of the face, neck and the front of the upper chest was observed. She was re-intubated 20 min after extubation. Chest X-ray after the second intubation showed an enhanced soft tissue shadow in both upper lung fields compared to the image taken after the first re-intubation (Figure 1a and Figure 1b).

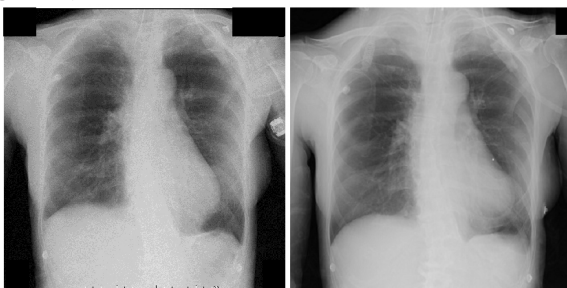


Figure 1: Case 2. Chest radiography obtained after the first re-intubation on post-operative day 1 (a), and after the second re-intubation on the same day (b), showing enhancement of the soft tissue shadow in both upper lung fields after the second re-intubation.

To explore the cause of stridor and respiratory distress, CT of the head and neck was conducted, which revealed the filled intraoral cavity and marked left-side deviation of the trachea compressed by swelling of the soft tissue and muscles (Figure 2a and Figure 3a).

Ultrasonography of the neck showed no obvious thrombus in the right internal jugular vein on postoperative day 2 (Figure 4). She was kept in the head-up position, and betamethasone was administered intermittently to improve the swelling.

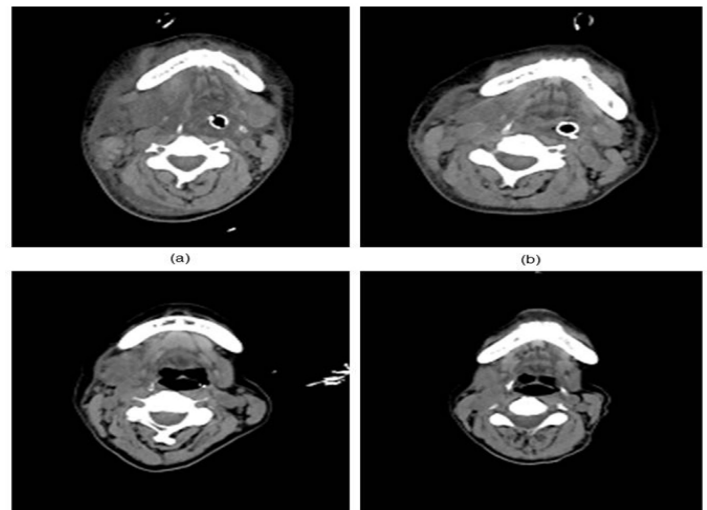


Figure 2: Case 2. Computed tomography images at the level of the superior border of the hyoid bone: (a) The intraoral cavity filled with soft tissue swelling and compressed by right submandibular gland swelling on postoperative day 1, (b) progressive swelling of the soft tissue and right submandibular gland in the oral cavity on day 7, (c) remaining submandibular gland swelling on day 20, and (d) swelling almost completely resolved on day 45.

CT of the head and neck was repeated on day 7 (Figure 2b and Figure 3b), which showed progressive swelling of the face and neck. Surgical tracheotomy was performed on the same day. She was transferred to the medical ward on day 8. Repeated CT of the neck on day 20 showed gradual improvement of the swelling in the submandibular gland and soft tissue (Figure 2c and Figure 3c).

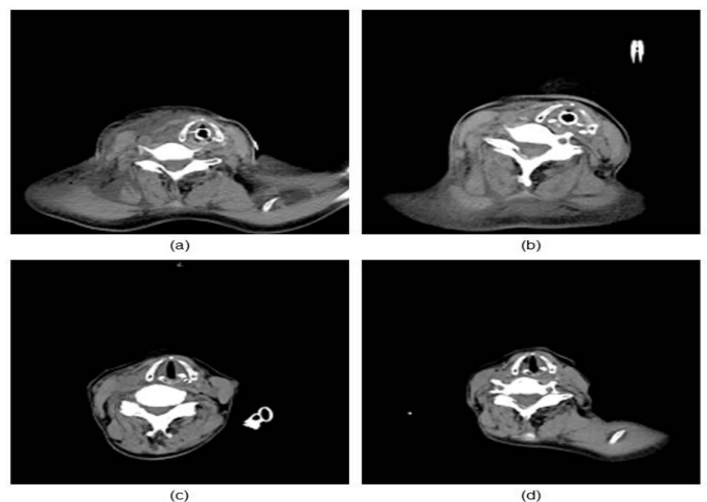


Figure 3: Case 2. Computed tomography images at the arytenoid cartilage level: (a) Marked deviation of the trachea due to swelling of the soft tissue and muscles on the post-operative day 1, (b) progressive soft tissue swelling on day 7, (c) soft tissue swelling and trachea deviation gradually improved on day 20, (d) swelling almost completely resolved and the trachea in the medium position on day 45.

The tracheostomy orifice was closed on day 42. The swelling resolved almost completely and the trachea was in the medium position on day 45 (**Figure 2d** and **Figure 3d**). Weakness of the right upper extremity, suspected to be due to the right brachial plexus injury, remained despite rehabilitation, and she was transferred to a rehabilitation hospital on day 48.

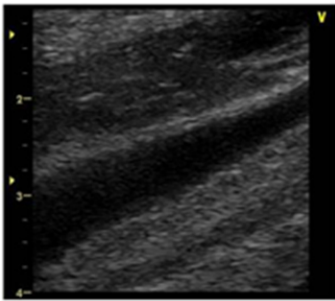


Figure 4: Case 2. Ultrasonogram showing no obvious thrombus in the right internal jugular vein on postoperative day 2.

Discussion

Ideal patient positioning involves balancing surgical access with the risk related to the patient position. The park-bench position is a modification of the lateral position, which provides the surgeon with better access to the posterior fossa, compared to the lateral position. Several complications, including quadriplegia, cerebral infarction, and brachial plexus injury, have been well documented during specific positioning in neurosurgical patients [1]. However, delayed swelling of the neck and face after neurosurgical surgery in specific positions, including lateral, lateral semiprone and park-bench positions, has been rarely reported.

To the best of our knowledge, we have found only seven reported cases in the English literature, including our two cases [2-6] (**Table 1**). Four of the seven cases required emergency endotracheal intubation or tracheotomy, and one remained

intubated postoperatively [2-4,6]. All of these cases were reported from Asian countries; India, Japan and Taiwan. Four cases reported height and weight of the cases with their body mass index was $\leq 19.2 \text{ kg/m}^2$. During positioning, the head can typically be safely rotated between 0 and 45 degrees away from the body [1]. Maintaining two to three finger-breadths thyromental distance is recommended during neck flexion [1]. However, there are no restrictions on lateral flexion of the neck. To gain optical surgical access to the posterior fossa, the neck of some patients might be excessively flexed laterally, especially if they are underweight. Head positioning can cause obstruction of the cerebral lymphatic and venous outflow, leading to face, neck, and/or airway swelling [1]. The park-bench position may alter cerebral venous drainage by affecting venous flow through the internal jugular vein (IJV) due to kinking of the IJV with excessive neck flexion and rotation [7]. It is therefore possible that neck swelling and airway obstruction occurring with the park-bench position might be due to venous congestion of the neck [2]. However, Yeoh et al. reported that in healthy volunteer subjects there was no significant difference in the mean venous flow rate of the right IJV between in the right park-bench position and the supine position [8]. Furthermore, there was no intraoperative brain swelling or increased venous bleeding during surgery in our present patients. Therefore, venous obstruction alone does not appear to explain the mechanism for swelling of the neck. Given that the swelling occurred a few hours after the operation and persisted for a few weeks, we speculate that reperfusion of the soft tissue of the neck after compression due to neck hyperflexion might have caused the swelling.

In conclusion, we report two cases of delayed airway obstruction after craniotomy in the park-bench position. We also found five case reports of the same complication in the English literature, most of the patients requiring emergency airway management. All reported cases were from Asian countries, and were likely to be underweight. We warn that hyperflexion of the neck in the park-bench position might cause delayed airway swelling, especially for patients who are underweight.

Table 1: Summary of cases of delayed onset of neck and face swelling after craniotomy in the park-bench or lateral position.

References	Country	Age (years) / Sex	Height(cm) / Weight (kg) (BMI)	Position	Operation time	Onset of swelling	Intervention (Time)	Outcome
Narayan et al. 1999 [3]	India	40 / F	? / 45	Lateral	8h	2h	Tracheostomy (2h 30min)	Good
Shimizu et al. 2009 [4]	Japan	56 / F	154 / 43 (18.1)	Park-bench	10h	2h	Intubation in place*	Left brachial plexopathy
Koizumi et al. 2012 [5]	Japan	43 / M	? / ?	Park-bench	?	13h	None	Good
Hsu et al. 2012 [2]	Taiwan	46 / F	? / ?	Park-bench	8h	2h	Reintubation (2h)	Good
Nakanishi et al. 2015 [6]	Japan	33 / M	174 / 56 (18.5)	Lateral semiprone	4h	7h	Reintubation (7h)	Good
Present case 1	Japan	29 / M	170 / 46 (15.9)	Park-bench	12h	14h	None	Good
Present case 2	Japan	63 / F	153 / 45 (19.2)	Park-bench	12h	11h	Reintubation (1h, 11h 20min)	Right brachial plexopathy

BMI: body mass index. Onset of swelling and intervention time are listed as time from the operation.

*The patient was extubated on the 11th postoperative day.

Conflict of interest

The authors have no conflicts of interest to declare related to this study.

References

1. Rozet I, Vavilala MS (2007) Risks and benefits of patient positioning during neurosurgical care. *Anesthesiology Clin* 25: 631-653.
2. Hsu S, Hsieh C, Huang C, Huang J (2012) Delayed airway obstruction in posterior fossa craniotomy with park-bench position - A case report and review of the literatures. *Surg Sci* 3: 526-529.
3. Narayan VB, Umamaheswara GS (1999) Unilateral facial and neck swelling after infratentorial surgery in the lateral position. *Anesth Analg* 89: 1290-1291.
4. Shimizu S, Sato K, Mabuchi I, Utsuki S, Oka H, et al. (2009) Brachial plexopathy due to massive swelling of the neck associated with craniotomy in the park bench position. *Surg Neurol* 71: 504-508.
5. Koizumi H, Utsuki S, Inukai M, Oka H, Osawa S, et al. (2012) An operation in the park bench position complicated by massive tongue swelling. *Case Rep Neurol Med*.
6. Nakanishi H, Tono T, Ibusuki S (2015) Postoperative submandibular gland swelling following craniotomy under general anesthesia. *Case Rep Otolaryngol*.
7. Gisolf J, van Lieshout JJ, van Heusden K, Pott F, Stok WJ, et al. (2004) Human cerebral venous outflow pathway depends on posture and central venous pressure. *J Physiol* 560: 317-27.
8. Yeoh TY, Tan A, Manninen P, Chan VWS, Venkatraghavan L (2016) Effect of different surgical positions on the cerebral venous drainage: a pilot study using healthy volunteers. *Anaesthesia* 71: 806-813.

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