An Accidental Bronchial Obstruction Caused by Detached Cuff: Case Report and Literature Review

Kaibin Zhu

Harbin Medical University Cancer Hospital

Jianlong Bu

Harbin Medical University Cancer Hospital

Mengfeng Liu

Harbin Medical University Cancer Hospital

Changjun He

Harbin Medical University Cancer Hospital

Yaoguo Lang

Harbin Medical University Cancer Hospital

Shidong Xu (✉ xushidong1962@outlook.com)

Harbin Medical University Cancer Hospital <https://orcid.org/0000-0001-5438-2014>

Case report

Keywords: bronchial blockers, cuff, thoracic surgery, obstruction

Posted Date: September 14th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-70835/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background The airway obstructions are usually caused by secretions, mucus plugs, blood clots, malposition of bronchial blockers (BBs) cuff or twist of the tube by oral biting. In this paper, we report a case of accidental bronchial obstruction as a result of a cuff detaching from the BBs catheter.

Case presentation A 48-year-old male was admitted to our department due to small cell lung cancer. He had received two cycles of neoadjuvant chemotherapy with etoposide plus cisplatin and was scheduled a right upper lobe resection by thoracotomy. During the surgery, the patient was intubated with an 8.0-mm internal diameter BBs tube (Univent tube). When the anesthesiologist tried to remove the BBs towards the end of surgery, the cuff got detached accidentally and obstructed the airway leading to improper expansion of the middle lobe. This condition was determined later by the 6.0-mm bronchoscope and the cuff was removed with forceps.

Conclusions We report this case aiming to remind other colleagues that the cuff detachment in the surgical procedure is still a potentially fatal incident even it rarely happens nowadays. It is important to check the BBs apparatus meticulously through the whole operative procedure. The routine use of 4.0-mm bronchoscope should be highly recommended during the entire airway management when a bronchial obstruction is suspected.

Background

Bronchial blockers (BBs) are used extensively in thoracic surgery to provide one-lung ventilation (OLV) because of some advantages over double-lumen tube (DLT) ^[1]. The Mourisse's research shows that there are a few major complications with the application of BBs tube ^[2]. Most of the complications are minor-superficial airway injuries ^[3, 4]. But along with the increasing use of BBs, some accidental or rare incidents have increased. The airway obstruction caused by the deciduous cuff detachment is one of these rare complications. This kind of airway obstruction is difficult to be detected and might lead to patient's death. We report a case that a cuff detachment from the BBs catheter caused the patient's right middle lobe bronchial occlusion and discuss some related researches in this article.

Case Presentation

A 48-year-old male patient who was diagnosed with small cell lung cancer was admitted to our department of thoracic surgery for a right upper lobe resection through thoracotomy. He had received two cycles of neoadjuvant chemotherapy with etoposide plus cisplatin and had got partial remission before the surgery. We performed the fiberoptic bronchoscope to confirm no abnormalities in the patient's tracheal tree before the operation. The patient was under general anesthesia during the whole surgical procedures. An arterial catheter was indwelled in the dorsal foot artery to monitor the blood pressure besides routine monitoring of other vital signs. All the BBs apparatus were checked cautiously before the procedures. We intubated the patient with an 8.0-mm internal diameter BBs tube (Univent tube) by a

visual laryngoscope. After the bronchial blockers catheter was placed blindly through the endotracheal tube (ET), due to the relative insufficiency of 4.0-mm fiberoptic bronchoscopes, we confirmed that it was in place by auscultation. Then 5 ml air was injected into the BBs cuff through the proximal pilot inflator to fix the catheter in place.

The patient was placed slightly at the left lateral position. After the right lung deflated to full satisfaction, the surgeon began to dissociate the lung. Owing to the excessive huge size of the tumor and abnormal enlarged lymph nodes, it became very difficult for the surgeon to expose of pulmonary vessels and bronchus. When the right upper bronchus was ready to be removed by stapler, the residual lobe was re-expanded routinely. The BBs catheter was withdrawn back in order to prevent being stapled or sewn together with the bronchus. At the same time, the middle lobe still remained normal inflation and deflation ideally. When the surgeon finished the excision of subcarinal lymph nodes, the patient suddenly experienced several episodes of atrial fibrillation. We speculated that the manipulation of lymph nodes dissection was the main cause of the atrial fibrillation. We stopped the operation and gave the patient 150 mg amiodarone by IV push immediately. Half hour later, the atrial fibrillation was not controlled and the hemodynamic (heart rate elevated to 132/min, blood pressure dropped to 90/60 mmHg) became unstable. The anesthesiologist considered the prolonged time OLV as a possible trigger of the persistent arrhythmia. Because the OLV was no longer required for the following procedures, the anesthesiologist pulled BBs catheter out to end the OLV and allow the collapsed lung lobe inflate.

Prior to closure of the incision, the surgeons observed that the middle lobe re-expanded insufficiently and collapsed gradually soon, whereas the lower lobe re-expanded properly. After several attempts to inflate the middle lobe, it remained collapsed. There was neither air leakage nor bronchial twist in the remnant lung, and not too much mucus plugs in the bronchus through the iterative suction. The attending anesthesiologist checked the anesthetic equipment carefully again, and found that the BBs catheter withdrawn from patient was defective (Fig. 1A) while compared with the intact one (Fig. 1B). The endoscope doctor performed an emergent 6.0-mm fiberoptic bronchoscope, through which the doctor figured out the middle lobe bronchus obstructed incompletely by the balloon cuff. The cuff was elastic and plastic. At first, we thought that it supposed to be pulled out easily from the ET. However, the cuff sustained stuck due to the loose of biopsy forceps with the first try. The doctor clamped it again immediately and pulled it out successfully this time (Fig. 2). The removal cuff was intact and no any foreign object remained in the bronchus under bronchoscopic visualization (Fig. 1C). During the removal procedure, the patient's oxygen saturation was always kept at 100%. After the cuff was removed, the middle lobe re-inflated smoothly. At the end of the operation, the patient's atrial fibrillation recovered and the hemodynamic (heart rate 92/min, blood pressure 120/85 mmHg) became stable. The patient was discharged seven days later with an uneventful postoperative course.

Discussion And Conclusions

Nowadays the BBs has become more and more popular for OLV because of advantages over DLT in procedures, such as tracheostomy, intubation for pediatric patients, patients requiring postoperative

ventilation, et al ^[1]. It also possessed some advantages when compared with DLT, including minor airway trauma, less possibility for airway rupture, and lower rate of complications ^[3, 4]. However, there are a few disadvantages of the BBs tube. The BBs tube requires longer time to intubate and collapse lungs. Malposition, contamination of the healthy lobes, and sewn by stapler are more prone to happen with BBs than DLT. ^[5–7].

Bronchial obstruction is not a new situation in intubation, which is mostly caused by secretions, pus, mucus plugs, blood clots, malposition of BBs cuff or twist of the tube by oral biting ^[8, 9]. A small portion of obstructions are caused by tumor embolus, variant bronchus, cuff hyperinflation or malfunction of ET ^[10–13]. Occlusion caused by the detached balloon cuff is really rare and difficult to be figured out.

In our hospital, the 4.0-mm bronchoscopes are often relatively insufficient to meet a large number of thoracic surgeries. Some anesthesiologists may intubate patients with “blind method”. The position of the BBs has to be confirmed through chest auscultation and clinical confirmation. In most cases, the method is reliable and effective, and the 4.0-mm bronchoscope is unnecessary for adjusting the BBs’ position ^[14, 15]. In this case, we got a satisfactory surgical field through blind intubation, but we failed to detect the unexpected bronchial obstruction without 4.0-mm bronchoscope timely. In order to prevent this kind of incidents, we should better use the 4.0-mm bronchoscope to monitor the whole BBs tube manipulations, including positioning, inflation, and deflation of the cuff.

It is very hard to explore the cause of middle lobe collapse without bronchoscope. At first, we suspected the middle lobe bronchus was obstructed by sputum, but there was very little secretion in the airway according to the iterative suction. The suction tube passed through the ET without any resistance, so we didn’t realize that it was the problem of a detached BBs cuff. The anesthesiologist confirmed to have deflated the proximal pilot inflator. It is most probable that the balloon cuff failed to deflate because of the mechanical malfunction of BBs device ^[16]. The cuff completely detached from the BBs catheter, which was withdrawn with extra force. We should be vigilant to avoid violent extubation when greater resistance is encountered. The cuff was coincidentally blown into the middle lobe bronchus by continuous positive airway pressure, which aimed to inflate the collapsed lung. Because of loosely wedge within the bronchus, the cuff just resulted an incomplete obstruction, which made the middle lobe able to inflate slowly. Routine inspection of the integrity of BBs catheter was neglected, otherwise the cuff detachment could be revealed in time. Therefore, it is important to inspect the BBs after removal to ensure the entire blocker has been removed from the patient’s airway. Although the patient had good outcomes, we still need to keep alert of the possibility of such kind of accidents. The balloon cuff might tightly wedge within the ET, and lead to a deadly complete airway obstruction which requires re-intubation in the lateral position. We were professional enough to detect the abnormal phenomenon before the end of surgical procedure, and make an appropriate decision to perform the 6.0-mm bronchoscope timely. The action prevented a serious iatrogenic event which might lead the patient death from happening.

In conclusion, the BBs tube malfunction did not generally appear in modern anesthesia due to strict quality control. Therefore, the cuff detachment might remain unnoticed during routine inspection, as what

occurred in this case. We report this case to alert other colleagues that cuff detachment is still a possible event even it rarely happens. We should be vigilant to avoid violent extubation when greater resistance is encountered. It is important to check the BBs apparatus meticulously during the whole operative procedure. Surgeons must be aware of any unusual signs during the procedures of anesthesia and surgery so that undesirable complications could be detected immediately. Because direct visualization could clearly demonstrate the cause, the routine use of 4.0-mm bronchoscope during the entire airway management are highly recommended.

Abbreviations

BBs: bronchial blockers; OLV: one-lung ventilation; DLT: double-lumen tube; ET: endotracheal tube.

Declarations

Ethical Approval and Consent to participate

The patient signed the comprehensive written informed consent about the use of his clinical data for research. The consent has been approved by our hospital's ethical committee.

Consent for publication

The authors certify that they have obtained the patient's written consent form. In the form the patient has given his consent for his images and other clinical information to be reported in the journal.

Availability of data and materials

Not applicable.

Competing interests

The authors declare no competing interests in association with the present work.

Funding

This work was supported by Hai Yan fund of Harbin Medical University Cancer Hospital (JJQN2019-08) and Scientific research subject of Heilongjiang Health Committee (2019-061).

Authors' contributions

Kaibin Zhu, Jianlong Bu, Mengfeng Liu¹, Changju He, Yaoguo Lang, and Shidong Xu participated in the drafting of the article. All of the authors have read and approved the final manuscript.

Acknowledgement

I would like to express my gratitude to the LinkDoc Data which offered me references and information on time.

References

1. Neustein SM. Pro. Bronchial Blockers Should Be Used Routinely for Providing One-Lung Ventilation. *J Cardiothorac Vasc Anesth*. 2015;29(1):234–6.
2. Mourisse J, Liesveld J, Verhagen A, et al. Efficiency, efficacy, and safety of EZ-blocker compared with left-sided double-lumen tube for one-lung ventilation. *Anesthesiology*. 2013;118:550–61.
3. Ueda K, Goetzinger C, Gauger EH, et al. Use of bronchial blockers: A retrospective review of 302 cases. *J Anesth*. 2012;26:115–7.
4. Clayton-Smith A, Bennett K, Alston RP, et al. A comparison of the efficacy and adverse effects of double-lumen endobronchial tubes and bronchial blockers in thoracic surgery: A systematic review and meta-analysis of randomized controlled trials. *J Cardiothorac Vasc Anesth*. 2015;29(4):955–66.
5. Brodsky JB. Con. A Bronchial Blocker Is Not a Substitute for a Double-Lumen Endobronchial Tube. *J Cardiothorac Vasc Anesth*. 2015;29(1):237–9.
6. Soto RG, Oleszak SP. Resection of the Arndt bronchial blocker during stapler resection of the left lower lobe. *J Cardiothorac Vasc Anesth*. 2006;20:131–2.
7. Itani O, Mallat C, Jazzar M, et al. Obstruction of a non-resterilized reinforced endotracheal tube during craniotomy under general anesthesia. *Anesth Essays Res*. 2015;9:260–2.
8. Li H, Fu Q, Jin C. An unusual airway obstruction caused by partial detachment of inner layer of reinforced endotracheal tube. *Paediatr Anaesth*. 2016;26:943–94.
9. Choi YH, Lee DH. A Rare Airway Obstruction Caused by Dissection of a Reinforced Endotracheal Tube. *J Emerg Med*. 2018;54(4):e73–5.
10. Kim SH, Park AY, Cho HB, et al. A rare case of nonresterilized reinforced ETT obstruction caused by a structural defect. *Medicine*. 2017;96(48):e8886.
11. Zenga J, Galaiya D, Choumanova I, et al. Endotracheal Tube Obstruction Caused by Cuff Hyperinflation. *Anesthesiology*. 2018;129(3):581.
12. Lee DK, Kim H, Lim SH, et al. Bronchial obstruction by tumor embolus of contralateral lung during pneumonectomy: report of a case. *J Cardiothorac Surg*. 2013;8:26.
13. Cho HB, Kim HJ, Gong HY, et al. Incidental left main bronchus obstruction during left-sided double-lumen tube intubation of a patient with an unrecognized tracheal bronchus: A case report. *Medicine*. 2016;95(52):e5674.

14. Wang ML, Wang YP, Hung MH, et al. Is fibre-optic bronchoscopy necessary to confirm the position of rigid-angled endobronchial blockers before thoracic surgery? A randomized controlled trial. *Eur. J Cardiothorac Surg.* 2018;53(1):241–6.
15. Amin N, Tarwade P, Shetmahajan M, et al. A randomized trial to assess the utility of preintubation adult fiberoptic bronchoscope assessment in patients for thoracic surgery requiring one-lung ventilation. *Ann Card Anaesth.* 2016;19(2):251–5.
16. Honikman R, Rodriguez-Diaz CA, Cohen EA, Ballooning Crisis. Three Cases of Bronchial Blocker Malfunction and A Review. *J Cardiothorac Vasc Anesth.* 2017;31(5):1799–804.

Figures

Figure 1

The defective catheter comparing with normal catheter. A: the defective BBs catheter without the balloon cuff; B: the normal BBs catheter. C: an intact balloon cuff separating from the BBs catheter;

Figure 2

The procedure of removing the cuff A: the cuff edge was clipped and pulled out by biopsy forceps; B: the cuff stuck in the endotracheal tube due to the loose of biopsy forceps; C: the biopsy forceps attempted to clip the cuff again and pulled it out successfully.