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CLINICAL REPORT

Use of bronchial blockers: a retrospective review of 302 cases

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Abstract The purpose of this retrospective review is to evaluate the safety and efficacy of the bronchial blockers (BBs) used in thoracic anesthesia. We enrolled 302 patients who had a BB placed to achieve one-lung ventilation (OLV). Variables recorded from the anesthetic record included type of device used, type and side of surgery, specific indications for OLV, Mallampati score, route of intubation, and complications related to the use of BBs. The BBs used include the Arndt Wire-guided, Univent, Cohen Flexi-tip, Fogarty catheter, and Fuji. The majority of BBs placed were Arndt ($n = 156$) or Univent ($n = 131$). BBs were used significantly more often in thoracoscopic procedures than in thoracotomies ($P < 0.01$). Of the 251 patients, 216 (86%) had a Mallampati score of I/II and 35 (14%) had a score of III/IV. There were no identified complications related to BBs. In summary, BBs can be safely used to achieve OLV and offer advantages for OLV in specific situations.

Keywords One-lung ventilation · Bronchial blocker · Lung isolation

Introduction

One-lung ventilation (OLV) is required for patients undergoing thoracic or cardiac surgery to facilitate surgical exposure. Currently, there are two methods for achieving lung isolation: double-lumen endotracheal tubes (DLTs), and bronchial blockers (BBs). [1] Clinical outcomes in a large series of patients involving the use of DLTs has been reported [2]; however, to date there is no retrospective study on clinical outcomes with a large number of the use of BBs. The aim of this retrospective review is to assess the safety and advantages of BBs in the thoracic surgical patient.

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Materials and methods

After approval by the Institutional Review Board, we reviewed 880 charts of patients who underwent OLV for thoracic surgical procedures from July 1996 to August 2007. Variables recorded included type of BB used, type and side of surgical procedure, Mallampati score, route of intubation, specific indications for the BB, and complications requiring medical treatment related to use of the BB. Mallampati score from the patients who had DLT intubation during the same period of time was also recorded as control. Statistical analysis was performed using SPSS 17.0 (Chicago, IL, USA). Data was compared with the chi-square test or binomial test. A P value less than 0.05 was considered to be significant.

Results

Of the 880 patients reviewed, OLV was achieved in 302 patients using a BB. Five different types of BBs were identified, including Arndt (52%), Univent (43%), Cohen (3%), Fogarty (1%), and Uniblocker (1%). The BB was

used significantly more frequently during thoracoscopic surgery compared with thoracotomy (95 vs. 178; $P < 0.01$). The ratio of Mallampati score of III–IV/I–II in the patients with BBs was significantly higher than that of DLT [35/216 vs. 48/530, $P = 0.01$; odds ratio (OR) = 1.79; 95% confidence interval (CI) = 1.13–2.84]. Most patients were orally intubated (90%), and 6 (2%) were already intubated upon their arrival in the operating room. In addition to oral intubation (92%), BBs were successfully placed in patients with tracheostomies (7%), as well as patients who were nasally intubated (1%). In addition, we identified 8 patients who had selective lobar blockade with a BB. There was no major complication related to any type of BBs in the study patients.

Discussion

Our results indicate that BBs are a safe and effective method to achieve lung isolation for both left- and right-sided operations.

In a previous study [3, 4], several advantages of DLT over BB were identified. DLT took less time to place, had a faster time to achieve lung collapse, and had a fewer malpositions. More frequent malpositions with the BB may explain why in our review the BB was less often used in thoracotomy procedures. These procedures often have surgical manipulation around the carina that can cause a BB to be dislodged, and thus would requires frequent repositioning of a BB during the procedure.

Although there have been some studies showing benefits of using DLTs over BBs, it is important to recognize unique situations in which BBs may be the preferred or only device able to achieve OLV. First, BB placement through an existing single-lumen endotracheal tube (SLT) provides the benefit of less placement time and ease of procedure. Using a DLT requires the exchange from an SLT to a DLT, which in itself poses unnecessary added risk to the patient. ETT exchange can be challenging because of an edematous airway and potentially compromise the airway. Using an existing SLT also eliminates the need for postoperative tube exchange for patients who remain intubated. Second, patients in whom a DLT cannot be placed are a definite indication for a BB. This category may include patients who require awake intubation, nasotracheal intubation, or intubation through a small-size tracheostomy stoma, all situations encountered in our review. Third, applying a BB for patients with potentially difficult airways has an advantage for intubation because an SLT gives a greater chance of successful intubation. In our data set, SLTs with a BB were preferred in patients with a potentially difficult airway. Compared with thoracic cases with the DLTs group in the same study period, the patients with BBs had a significantly higher incidence of Mallampati score of III/IV. Finally, selective lobar blockade is a unique ability of the BB that cannot be accomplished with a DLT. Selective lobar blockade can provide better oxygenation during lung isolation, and it is especially useful for patients with a previous lung resection [5].

Table 1 Case reports of complications associated with bronchial blockers

Author	Type of blocker	Complications
Soto [6]	Arndt®	Guidewire was left in during procedure and was included in the staple line
Sandberg [7]	Arndt®	Blocker was dislodged from left mainstem bronchus into the trachea and caused air to be trapped in the nondependent lung, which resulted in increased thoracic pressure and significantly decreased preload
Prabhu [8]	Arndt®	When removing the blocker, the balloon was detached from the catheter because of resistance from the Tuohy-Borst valve
Barrick [9]	Arndt®	When the balloon was inflated with more than 4 ml of air, it inflated asymmetrically and was not able to provide OLV
Peragallo [10]	Univent®	Right lung could not be isolated with a bronchial blocker because the patient had a tracheal right upper lobe bronchus
Park [11]	Univent®	Secretions accumulated distal to the blocker cuff in the left lung, and when the cuff was deflated the secretions spilled into the trachea and right bronchus
Baraka [12]	Univent®	Suction was used to deflate the nonventilated lung before the chest was opened, which resulted in a dramatic fall in oxygen saturation; this was reversed by removing the suction
Doi [13]	Univent®	A piece of the slip joint broke off and was discovered postoperatively while suctioning the trachea using fiberoptic bronchoscopy
Campos [14]	Univent®	The bronchial blocker cap detached while placing the patient into the lateral decubitus position. In a second case, the bronchial blocker cap fractured when the cap connector was closed
Neustein [15]	Cohen®	Difficulty placing the blocker in the left mainstem bronchus
Thielmeier [16]	Univent®	Part of the balloon was included in the staple line during a right upper lobectomy

Although BBs provide unique advantages in certain situations, a series of different complications have been reported with BBs (Table 1) [6–16]. However, in our 302 cases, no major complications were observed; thus, the risk of major complications using BBs is estimated to be less than 1% [17].

There are several limitations of this study because it is retrospective in nature. Many aspects of intraoperative management associated with BBs could not be assessed, including time needed to place a BB, time required to collapse the lung, and the need to reposition a BB during the operation. However, these conditions have all been studied and reported [3, 4], and in each case DLTs have been shown some advantages over BBs. Regarding safety of using BBs, minor adverse events, which were not recorded in the anesthesia charts, were neglected. Also, as shown in the results, the BB was used more frequently in thoracoscopic surgery, which is a simpler procedure of shorter duration than thoracotomy surgery in general. Thus, it is possible that the risks of complications or adverse events could be underestimated.

In conclusion, our review showed that BBs can be effectively and safely used for right- and left-side lung isolation. BBs were preferred for use in a thoracoscopic procedure. Further studies are needed to identify the clinical application and safety of the different types of BBs for right versus left OLV.

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