August 2010

Single lung ventilation in a young child for repair of coarctation of aorta

Mohammad Hamid
Aga Khan University

Mansoor Ahmed Khan
Aga Khan University

Muneer Amanullah
Aga Khan University

CASE REPORT

Single Lung Ventilation in A Young Child for Repair of Coarctation of Aorta

Mohammad Hamid[1], Mansoor Ahmed Khan[1] and Muneer Amanullah[2]

ABSTRACT

Single lung ventilation in small children is extremely challenging. In this case, a paediatric bronchial blocker was successfully inserted in a 19-month-old child to provide single lung ventilation using a modified insertion technique. It provided excellent working conditions during thoracotomy and our method of insertion may help in reducing the cost.

Key words: *Lung isolation. Paediatric blocker. Children. Single lung ventilation. Repair. Coarctation of aorta.*

INTRODUCTION

Thoracic procedures in small children are technically challenging for anaesthetist particularly when single lung ventilation (SLV) is required to improve surgical exposure. There are several techniques available to ventilate just one lung and deflate other but all have some limitations. These techniques for selective ventilation include use of bronchial blockers,[1] selective main stem intubation, double lumen tube (DLT) and use of Fogarty catheter.[2]

This case report is the intraoperative use of Arndt paediatric bronchial blocker,[3] in a small child to provide one lung ventilation using a modified insertion technique. Blocker was placed in left main bronchus with the help of Fiberoptic bronchoscope (FOB) without using the blocker's guidewire.

CASE REPORT

A 19-month-old boy weighing 14 kg. was admitted for coarctation of aorta repair. His transthoracic echocardiography revealed bicuspid aortic valve, moderate to severe juxta ductal discrete coarctation of aorta. His heart rate was 93 beats/minute and there was disparity between upper limb BP (127/71 mmHg) and lower limb blood pressure (77/ 30 mmHg). Surgical plan was to carry out end-to-end anastomosis of coarctation through left thoracotomy for which surgeon requested collapsed left lung.

Patient was pre-medicated with syrup chloral hydrate 40 mg/kg. In the operating room, inhalation induction was performed using sevoflurane, oxygen and nitrous oxide. Fentanyl (100 µgm) and muscle relaxant atracurium (5 mg) was administered to facilitate intubation. Cuffed endotracheal tube (size 5.0 ID) was placed in trachea without difficulty. Right radial and femoral arterial lines were inserted while central venous pressure was monitored through a CVP place in left femoral vein.

Arndt paediatric endobronchial blocker 5F was planned for lung isolation. This blocker has high volume low pressure 2 ml spherical balloon at the tip. Cost of this blocker is quite high and it is for single time use only. This blocker has a nylon guide loop through which FOB (2.2 mm external diameter Olympus) supposed to be inserted and then guide the blocker into bronchus. This nylon loop once retracted cannot be pushed back. The blocker pack was previously opened and nylon loop was pulled back accidently. The blocker was resterilized without the nylon loop and used it. The patient was ventilated with 100% O_2 while FOB was prepared. Endobronchial blocker and FOB were lubricated. Arndt multiport airway adopter attached to ETT. Balloon of endobronchial blocker was fully deflated. Blocker was slightly bend at distal end and inserted through the blocker port of multiport airway adopter (Figure 1) then FOB was inserted through the FOB port. Once bronchoscope reached the distal trachea, the tip of the blocker was identified and guided into the left main bronchus under FOB vision. Ventilation was stopped for a few seconds before inflation of distal balloon and its

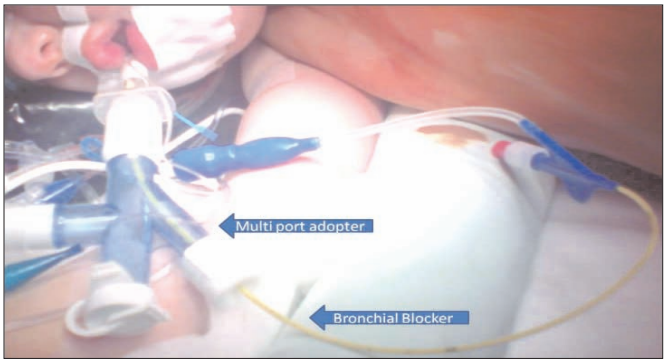

Figure 1: Arndt bronchial blocker passing through the bronchial port. FOB port and inflated pilot balloon can also be seen.

Department of Anaesthesia[1]/Cardiothoracic Surgery[2], The Aga Khan University Hospital, Karachi.

***Correspondence:** Dr. Mohammad Hamid, D-23, KDA Scheme No. 1, Off Miran Mohammad Shah Road, Karachi.*
E-mail: mohammad.hamid@aku.edu

Received April 08, 2009; accepted Febraury 21, 2010.

placement in the left main bronchus confirmed by FOB. Bronchoscope was removed and single lung ventilation was started with 100% oxygen. Ventilator was set at pressure control of 30 mmHg and respiratory rate of 25 beats/minute. Patient was positioned in the right lateral position and position of blocker was reconfirmed with the help of FOB before the start of surgery.

Patient's left lung remained collapse during surgery (Figure 2) and saturation was maintained between 95-99% on 100% oxygen. After the surgery, bronchial blocker balloon was deflated. The blocker was removed while leaving the ETT in its place. Both lungs started to ventilate and the patient was kept intubated electively. Later, patient was transferred to CICU where he was extubated on the same day and remained well thereafter.

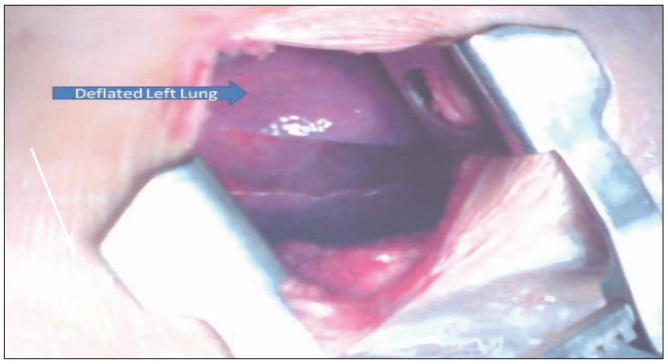

Figure 2: Collapsed left lung with the help of bronchial blocker.

DISCUSSION

There are very few case reports available in literature about the use of single lung ventilation in paediatric patients under 2 years. SLV is difficult to achieve in small children mainly due to technical hindrances and non-availability of specially designed paediatric equipment. Problems include non-availability of small DLT and univent tubes and also problem of dislodgement with traditional blockers and Fogarty catheter. In addition to that, paediatric patients are more prone to hypoxaemia during thoracotomy. It is important for anaesthetist to consider various options before deciding SLV. These considerations include availability of appropriate equipment according to age, complete knowledge of airway, and technical skills are required. The whole process could have monetary constraints on patient's part.

Double lumen tubes of paediatric size (under 8 years of age) are not available and the smallest size available is 26F. Marraro used a bilumen tube for infants successfully but his tube never achieved popularity.[4]

Conventional single lumen tube of 1.5-2.0 mm ID smaller than usual for age is commonly used for lung separation in children.[5] Problems include difficulty in placing ETT on the left side and blockage of upper lobe take-off in the right main stem intubation; use of smaller tube leads to higher airway pressure and possibility of inadequate seal, suctioning of non-ventilated lung is impossible and CPAP cannot be applied in case of hypoxemia. A modified SLT which takes care of most of these problems is univent tube. It has a built-in bronchial blocker and is available in smaller sizes of up to 3.5 mm ID but outer diameter is 8.0 mm which limits its use to older children.[6] Fogarty catheter is commonly used for vascular procedures but it has also been used for lung isolation.[7] It has a high pressure low volume cuff which keeps it in the bronchus but still associated with problems like dislodgement and absence of lumen for suction and application of CPAP.

Bronchial blockers are balloon tipped catheters with a hole at the end. A FOB is used for placement and confirmation. Disadvantages include dislodgement and obstruction of tracheal lumen and bronchial rupture due to over distention.[8] The used Arndt endobronchial blocker which was opened previously and its loop was retracted.[9,10] Still it could be inserted properly in the bronchus with the help of FOB. This shows that these blockers if adequately sterilized can be used more than once. In economically compromised countries it may be an option to use this blocker in several patients and distribute the charges to reduce burden on the parents.

REFERENCES

1. Garcia-Guasch R, Campos JH, Granell M, Pena JJ. Applications for bronchial blockers in thoracic surgery. *Rev Esp Anestesiol Reanim* 2007; **54**:547-55.
2. Terada Y, Matsukawa T, Takahashi K, Sasuga M, Ohkawa I. [Case report of using a connector (phycon TCB bronchial blocker) for pediatric one-lung anesthesia]. *Masui* 2007; **56**:334-6. Japanese.
3. Ho AC, Chen CY, Yang MW, Liu HP. Use of the Arndt wire-guided endobronchial blocker to facilitate one-lung ventilation for pediatric empyema during video-assisted thoracoscopy. *Chang Gung Med J* 2005; **28**:104-10.
4. Pawar DK, Marraro GA. One lung ventilation in infants and children: experience with Marraro double lumen tube. *Paediatr Anaesth* 2005; **15**:204-8.
5. Hammer GB, Fitzmaurice BG, Brodsky JB. Methods for single-lung ventilation in pediatric patients. *Anesth Analg* 1999; **89**:1426-9.
6. Hammer GB, Brodsky JB, Redpath JH, Cannon WB. The Univent tube for single-lung ventilation in paediatric patients. *Paediatr Anaesth* 1998; **8**:55-7.
7. Chengod S, Chandrasekharan AP, Manoj P. Selective left bronchial intubation and left-lung isolation in infants and toddlers: analysis of a new technique. *J Cardiothorac Vasc Anesth* 2005; **19**:636-41.
8. Brady KM, Harris ZL, Hammer GB, Berkowitz ID, Easley RB. Lung isolation in a child with unilateral necrotizing Clostridium perfringens pneumonia. *Crit Care Med* 2005; **33**:2676-80.
9. Wald SH, Mahajan A, Kaplan MB, Atkinson JB. Experience with the Arndt paediatric bronchial blocker. *Br J Anaesth* 2005; **94**:92-4. Epub 2004 Oct 14.
10. Tobias JD. Variations on one-lung ventilation. *J Clin Anesth* 2001; **13**:35-9.