

Comparison of EZ blocker and left double-lumen endotracheal tube for one lung ventilation in minimally invasive cardiac surgery

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participants were performed in accordance with
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Conflict of Interest

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Abstract

Background/Aim: Effective lung isolation is required in minimally invasive cardiac surgery. Double lumen tubes (DLT) are most preferred for this type of operation, and data on the use of EZ blockers in cardiac surgery are limited. We aimed to compare the efficiency of the double lumen tube and EZ blockers in minimally invasive cardiac surgery with cardiopulmonary bypass performed through a right mini thoracotomy.

Methods: A total of 89 patients who underwent minimally invasive cardiac surgery through right mini thoracotomy with cardiopulmonary bypass between January 1 and December 31, 2020, were included in this single-center, retrospective case control study. The group in which double lumen tubes were used for lung isolation (n = 58) was compared with that in which EZ blockers (n = 31) were used in terms of placement time, repositioning rate, lung collapse quality score, and postoperative sore throat and hoarseness.

Results: The time needed to place the devices in the correct position was shorter in the DLT group (3.2 (2.7) min vs 4.6 (2.4) min, $P=0.02$). No significant difference was found between the prevalence of at least one repositioning and lung collapse quality scores ($P=0.42$, $P=0.21$). VAS scores for sore throat were lower and hoarseness was less encountered in the EZ blocker group (21.2 (8.8) vs 49.4 (7.6), $P=0.01$, 16.1% vs 48.2%, $P=0.01$, respectively).

Conclusion: Although the EZ blocker has a longer placement time, it provides lung isolation as effective as DLT. Less sore throat and hoarseness show that EZ blocker is an important alternative for this type of surgery.

Keywords: Minimally invasive cardiac surgery, Lung isolation, bronchial blocker, Double-lumen tube

Introduction

Minimally invasive cardiac surgery (MICS), which is performed through a mini thoracotomy, has gained popularity in recent years. Minimal trauma, less postoperative pain, shorter hospital stays, and rapid recovery are among the most important advantages of this method [1, 2]. However, the small incision restricts the surgeon's vision and manipulations. One of the most important ways of reducing these restrictions is providing an effective lung isolation.

Double lumen tube (DLT) is the most used product for lung isolation, because of its easy accessibility, and low risk of malposition. Also, DLT allows continuous positive airway pressure to the deflated lung [3]. Bronchial blockers (BB) are different types of devices placed inside the endotracheal tube which provide effective lung isolation [4]. Although there are many types, the use of the EZ blocker (Teleflex Life Sciences Ltd., Athlone, Ireland), a Y-shaped BB, has increased due to its easy insertion and stability.

The superiority of these products to each other are still controversial. DLTs are easier to settle and cause lung deflation in a shorter time, whereas BBs cause less sore throat and hoarseness [5]. There is no clear information on the use of these products for MICS.

In this context, this study primarily aimed to compare the efficiency of DLT with an EZ blocker in MICS with cardiopulmonary bypass (CPB) performed through a right mini thoracotomy and evaluate the postoperative patient complaints.

Materials and methods

After the institutional ethics committee approval (Ankara University School of Medicine, AUTFKAEK 2021/127) was received and written inform consents were provided by the participants, patients who underwent nonemergent MICS with CPB through a right mini thoracotomy between January and December 2020 were approached for the study, retrospectively. Patients with an anticipated difficult airway, and prior thoracic radiotherapy were excluded. The groups in which DLT or EZ blockers were used for lung isolation were compared.

In the DLT group, a 35F, 37F or 39F left-sided double lumen endotracheal tube (Mallinckrodt Medical Ltd, Athlone, Ireland) was inserted according to the physical characteristics of the patients under video laryngoscopy and positioned using a fiberoptic bronchoscope. In the EZ blocker group, patients were intubated with a single-lumen endotracheal tube (internal diameter of 7.5 to 8.5 mm), and then the EZ blocker (Teleflex Life Sciences Ltd., Athlone, Ireland) (Figure 1) was inserted through the tube in the presence of a fiberoptic bronchoscope and anchored securely on the carina (Figure 2). After the surgery began, the right channel of the tube was clamped and opened to the atmosphere in the DLT group. In the EZ blocker group, after the lungs were completely deflated, the cuff in the right main bronchus was inflated and ventilation continued. During OLV, the peak pressure of the mechanical ventilator was set to remain below 25 cmH₂O and the EtCO₂, between 35-45 mmHg.

Placement time starting with laryngoscopy until the end of the control bronchoscopy, prevalence of at least one repositioning during surgery or one lung ventilation, quality of

lung collapse scores (1: no collapse, 2: partial collapse or 3: total collapse), duration of anesthesia, one lung ventilation (OLV), and surgery were recorded for both groups.

In the DLT group, the tube was replaced with a single lumen endotracheal tube at the end of the surgery. In the EZ blocker group, the blocker was removed from the tube and the patient was transferred to the intensive care unit. Visual analog scale (VAS) scores from 0 to 100 mm (0 = no pain and 100 = the worst pain imaginable) for sore throat and the presence of hoarseness were recorded after the patients were extubated in the intensive care unit.

Figure 1: EZ blocker



Figure 2: EZ blocker anchored on the carina



Statistical analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS, Version 15.0, Chicago, IL.). The data were presented as mean (SD) or median, as needed. Demographic and surgical parameters between groups and placement times were analyzed with the student-t test. Categorical variables, shown as frequencies and percentages, were evaluated with the Chi-square test. Surgical satisfaction and the quality of lung collapse were assessed with the Mann-Whitney U Test. *P*-values ≤ 0.05 were considered statistically significant.

Results

A total of 89 patients, 58 in Group DLT and 31 in Group EZ blocker, were included in the study. The two groups were similar in terms of age, gender, body mass index, types of surgeries, duration of anesthesia, OLV, and surgery (*P*>0.05 for all) (Table 1). The time required to place the devices in the

correct position was shorter in the DLT group [3.2 (2.7) min vs 4.6 (2.4) min, $P=0.02$]. No significant difference was found between the prevalence of at least one repositioning and lung collapse quality scores ($P=0.42$; $P=0.21$). However, VAS scores for sore throat were lower, and hoarseness was less encountered in the EZ blocker group (21.2 (8.8) vs 49.4 (7.6), $P=0.01$, 16.1 % vs 48.2 %, $P=0.01$, respectively) (Table 2).

Table 1: Demographic features of the patients and surgical data

	DLT (n:58)	EZ Blocker (n:31)	P-value
Age, y, mean (SD)	63.2 (11.3)	59.4 (12.5)	0.45
Sex (M/F)	31/27	17/14	0.37
Body mass index, kg/m ² , mean (SD)	26.4 (5.1)	25.9 (4.9)	0.52
Types of surgery, n (%)			
ASD closure	5 (8.6)	3 (9.6)	
Mitral valve surgery	22 (37.9)	13 (41.9)	
Aortic valve surgery	14 (24.1)	7 (22.5)	
Multiple valve surgery	12 (20.6)	5 (16.1)	
Intracardiac mass	5 (8.6)	3 (9.6)	
Duration of anesthesia (min), mean (SD)	252 (46)	261 (51)	0.26
Duration of OLV (min), mean (SD)	58 (16)	55 (19)	0.61
Duration of surgery (min), mean (SD)	221 (31)	224 (26)	0.57

DLT: Double Lumen Tube, ASD: Atrial Septal Defect, OLV: One Lung Ventilation

Table 2: Comparison of devices and postoperative complaints of the patients

	DLT (n:58)	EZ Blocker (n:31)	P-value
Placement time (min), mean (SD)	3.2 (2.7)	4.6 (2.4)	0.02
Prevalence of at least one repositioning [n (%)]	14 (24.1)	8 (25.8)	0.42
Lung collapse quality scores, mean (SD)	2.91 (0.41)	2.83 (0.37)	0.21
VAS scores for sore throat, mean (SD)	49.4 (7.6)	21.2 (8.8)	0.01
Hoarseness [n (%)]	28 (48.2)	5 (16.1)	0.01

DLT: double lumen tube, VAS: visual analog scale

Discussion

As there is no significant difference between lung collapse scores, EZ blockers can be used as effectively as DLT in MICS with CPB performed through a right mini thoracotomy. However, placement may take a little longer. Sore throat and hoarseness after extubation were less encountered when EZ blocker was used during this type of surgery.

Minimally invasive cardiac surgery has become widespread in recent years due to their advantages. In addition to its surgical features, it also requires varying anesthesia techniques such as lung isolation, venous cannulation, and monitoring. DLTs are more frequently used for lung isolation because they are easily accessible and inexpensive, but EZ blocker is also an alternative. Ruetzler et al. reported that although the time for intubation is longer, the EZ blocker is an efficient and easy-to-use device and can be used as an alternative to DLT [6]. In our study, the placement of the EZ blocker took longer. Considering that patients are transported to the intensive care unit while intubated after MICS, the lack of a need for tube replacement in patients who received the EZ blocker may compensate for this loss. Lu et al. stated that there was no significant difference between placement time in cases where lung isolation was performed for right video-assisted thoracoscopic surgery (VATS) [7]. However, the necessity of bronchoscopic control may be a limiting factor for EZ blockers.

One of the major problems during single lung ventilation is device malposition, which be caused by poor fixation, and the position of the patient. Morris et al. found no difference in terms of repositioning in patients who underwent left thoracic surgery, while the repositioning rate in the right sided cases was higher in the EZ blocker group [8]. Lu et al. could not detect any malposition difference in right VATS [7]. This difference may be due to patient positions. In our study, the repositioning needs were similar between the two groups. Unlike

thoracic surgery, we were able to position the patients with an inflatable pillow under the right thorax while in supine position.

It is critical for the surgeon to have good surgical vision during MICS. To facilitate this, the lung on that side must be deflated sufficiently. Grocott et al. did not find a difference in surgeon satisfaction when they compared DLT with a different bronchial blocker during port access cardiac surgery [9]. Since bronchial blockers have a thinner lumen, lung deflation times may be longer. In addition, proximal misplacement off the right upper lobe may cause insufficient lung deflation [10]. Yoo et al. stated that in cases where spontaneous collapse was achieved with BB, the surgical exposure was not equivalent to that with DLT. However, they reported no difference between BB use with the disconnection technique and DLT [11]. According to Cheng et al., there was no difference between BB with the disconnection technique and DLT in patients who underwent VATS [12]. In our study, we did not find any difference between the disconnection technique that we use in our routine practice and DLT in terms of lung collapse quality scores.

Besides all these, devices used for OLV may cause airway damage and consequently, sore throat and hoarseness. In many studies, tracheal hematoma, hyperemia, or bronchial hematoma were reported after DLT placement [13, 14]. The replacement of DLT with a single lumen tube after MICS can be considered to increase the possibility of added airway damage. Mourisse et al. reported that the group in which the EZ blocker was used for lung isolation had less sore throat on postoperative day 1 compared to the group in which DLT was used [15]. Zhong et al. found that both sore throat and hoarseness were less common when BBs were used [16]. Similarly, in our study, sore throat and hoarseness were significantly less common when EZ blocker was used.

This study has some limitations. First, due to the retrospective nature of the study, there was no randomization. Second, the fact that different specialists used these devices may have caused individual differences. Third, the difference in complication rates and pain scores after discharge were not evaluated. Prospective, randomized, double-blind, multicenter studies are needed to make these data clearer in this type of surgery.

Conclusion

Although the placement time is longer, the EZ blocker provides just as effective lung isolation as DLT in MICS with CPB performed through a right mini thoracotomy. The tube does not need to be replaced at the end of the surgery, and it causes less sore throat and hoarseness in the postoperative period.

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