Comparison of Double Lumen Tube Versus Single Lumen Tube with Bronchial Blockers for One Lung Ventilation in Thoracic Surgery. A Prospective Study.

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ABSTRACT

Background

The surgeries involving the thoracic surgeries require one-lung ventilation (OLV) to provide the best surgical exposure. The commonly used two methods include Double Lumen Tube (DLT) and Single Lumen Tube (SLT) with Bronchial Blocker (BB). The study will compare the effectiveness, complications, and patient results between these two techniques of OLV.

Objectives

The study aims to compare the efficacy, complications, and clinical outcome of Double Lumen Tube (DLT) with the Single Lumen Tube (SLT) with Bronchial Blocker(BB) in the process of One-lung Ventilation during thoracic surgery.

Methodology

This was a prospective study Conducted at department of Cardiothoracic Anesthesia Lady Reading Hospital MTI Peshawar Pakistan from jan 2020 to March 2020. 100 adult patients who had undergone thoracic surgery and needed OLV. The participants were randomly divided into the DLT group and the SLT +BB group. As the different parameters, the time of intubation, the quality of oxygenation, and the rate of complications (e.g., sore throat, tube migration), intraoperative stability were evaluated. There was also an analysis of data on oxygen saturation, arterial blood gases, and post-operative complications. Continuous variables were analyzed using a t-test, whereas categorical variables were analyzed using chi-square with a p-value of less than 0.05.

Results

The study found no significant difference in oxygenation levels and lung collapse between the two groups (p = 0.32). However, intubation time was significantly shorter in the DLT group (5.2 ± 1.5 minutes) compared to the SLT+BB group (7.4 ± 2.1 minutes), with a p-value of 0.001. Complications such as sore throat were more common in the DLT group (24%) compared to the SLT+BB group (10%) (p = 0.04). Tube displacement was more frequent in the SLT+BB group (14%) compared to the DLT group (6%), though this was not statistically significant (p = 0.09). Hemodynamic stability was similar across both groups, and recovery was quicker in the SLT+BB group with less airway irritation (p = 0.03). was 60. plus 10 years.

Conclusion

One-Lung Ventilation with Bronchial Blocker (BB) and Double Lumen Tube (DLT) is effective in thoracic surgery. DLT is quicker to intubate and lung isolation is more dependable, but leads to higher rates of airway trauma and sore throat. SLT+BB is less complicated with regard to challenging airway cases, though there is still tube displacement.

Keywords: One-lung ventilation, Double Lumen, Bronchial Blocker, Thoracic Surgery.

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Introduction

One-lung ventilation (OLV) is a basic procedure in thoracic surgery, which involves the isolation of one lung and the ventilation of the other to gain the best surgical exposure. It is especially valuable in the processes that involve the lungs, mediastinum, or esophagus so that the surgeon can operate on a collapsed lung, thereby boosting the visibility and reducing the chances of damaging the non-operated lung. The two most popular procedures for OLV are the Double Lumen Tube (DLT) and the Single Lumen Tube (SLT) with a Bronchial Blocker (BB). Although these two techniques are effective in attaining the isolation of the lungs, they come with various differences in ease of insertion, complication rates, comfort of the patient, and the intraoperative and postoperative management [1,2]. The Double Lumen Tube (DLT) has 2 lumens, one apiece to the two lungs, and is engineered in such a way that it can selectively ventilate either lung. It is normally applied in patients who have a normal anatomy of the airways, because placement needs a greater level of technical expertise. DLT offers greater security in lung isolation and provides the opportunity to ventilate the collapsed lung independently, although its use is associated with a greater risk of complications, including airway trauma, sore throat, and injury to the vocal cord, especially when misplaced or placed in the challenging airways. Moreover, the increased tube size may lead to a blockage of the airways or discomfort among patients with small airways [3,4]. Single Lumen Tube (SLT) with a Bronchial Blocker (BB), on the other hand, is a less invasive procedure. It involves the application of a standard endotracheal tube through which a bronchial blocker is introduced through a separate lumen, which isolates the lung by obstructing the bronchus of the non-operative lung. This is usually less traumatic and easier to locate than DLT, particularly in patients whose airways are challenging to locate. Nevertheless, the disadvantages of SLT with BB include slower lung collapse as well as an increased possibility of tube displacement. Besides this, oxygenation and ventilation are not necessarily as effective as DLT, especially where a specific lung isolation is needed. The major strength of SLT+BB is that it is more flexible and can be applied

to more problematic airways among patients [5,6]. Based on these variations, it will be a clinical dilemma to select either DLT or SLT+BB in OLV. Although most studies have been conducted to determine the efficacy of these techniques, there is no consensus on which technique is best, especially when pitting them off each other with respect to clinical outcome. There is a need to conduct more study, particularly on the intraoperative parameters such as intubation time, ease of lung isolation, complication rates, and postoperative recovery [7,8]. The proposed study is a prospective study that will compare the clinical outcomes of DLT and SLT to those of BB in OLV in thoracic surgery. This study aims to offer better recommendations to clinicians on the best technique to use in the process of lung isolation during thoracic surgeries by emphasizing the results, such as the duration of intubation, rate of complications, and the recovery period [9,10].

Materials and Methods

Study Design & Setting

This was a prospective study Conducted at department of Cardiothoracic Anesthesia Lady Reading Hospital MTI Peshawar Pakistan from jan 2020 to March 2020

Participants

100 adult patients undergoing an elective thoracic surgery that necessitated OLV. The inclusion criteria were patients between 18 and 80 years of age with an ASA I-III classification. Exclusion criteria were patients who had airway anomalies, had undergone tracheal surgery before, or were contraindicated for general anesthesia. Informed consent was also collected in written form before all the participants could join the study.

Sample Size Calculation

A calculated sample size was computed to ensure that it has enough power (80 percent) in order to find a difference between the intubation time and complication rates between the two groups with a significance level of 0.05. According to the previous study, at least 100 patients (50 in each of the groups) were necessary to obtain statistically significant findings on the main results.

Inclusion Criteria

Adults between 18 and 80 years, ASA I-III, planned to undergo elective thoracic surgery that demands OLV.

Exclusion Criteria

Patients who had difficult airways, anatomical defects, had undergone tracheal surgery, had severe comorbidities (e.g., severe pulmonary disease).

Diagnostic and Management Strategy.

Airway characteristics were assessed in all patients before the operation. The intraoperative management involved a general method of induction, then randomisation to either DLT or

SLT+BB group. The monitoring encompassed continuous pulse oximetry, blood gases, and hemodynamic parameters in the course of surgery.

Statistical Analysis

The SPSS software was employed in statistical analysis. Independent t-tests or Mann-Whitney U tests were used to compare the continuous variables where necessary. The analysis of categorical data was performed using chi-square or Fisher's exact tests. A p-value that was less than 0.05 was taken as significant. The answers were shown as means and standard deviation.

Results

A total of 100 patients were included in the analysis, with 50 patients in each group. The mean patient age was 60 ± 10 years. Both groups achieved similar oxygenation levels, with no significant difference in arterial oxygen tension ($p = 0.32$). Intubation time was significantly shorter in the DLT group (5.2 ± 1.5 minutes) compared to the SLT+BB group (7.4 ± 2.1 minutes), with a p-value of 0.001. The DLT group had a higher incidence of sore throat (24%) compared to the SLT+BB group (10%) ($p = 0.04$). Tube displacement was more common in the SLT+BB group (14%) than the DLT group (6%), but this was not statistically significant ($p = 0.09$). Hemodynamic parameters, including blood pressure and heart rate, were similar between the two groups throughout the procedure. Postoperative recovery was quicker in the SLT+BB group, with patients reporting less airway irritation ($p = 0.03$). Overall, the SLT+BB group had fewer complications and quicker recovery, but the DLT group showed better lung isolation and faster intubation times.

Intervention Outcome

Both DLT and SLT+BB methods were effective in the isolation of the lungs, but DLT was the one that obtained intubation faster, and the isolation was reliable. SLT+BB experienced fewer complications, such as sore throat and tube displacement. The SLT+BB group showed quicker recovery of the patient after the surgery with fewer airway irritations, which indicates its superiority in terms of patient comfort.

Table 1: Demographic and Baseline Characteristics of Participants

Characteristic	DLT Group (n=50)	SLT+BB Group (n=50)	p-value
Age (years)	60 ± 10	60 ± 10	0.95
Gender (Male/Female)	30/20	29/21	0.83
ASA Classification (I/II/III)	10/30/10	9/31/10	0.82
Comorbidities (Hypertension/Diabetes)	15/10	14/12	0.89

Table 1 presents the demographic and baseline characteristics of the participants. No significant differences were observed between the two groups regarding age, gender, ASA classification, or comorbidities (hypertension/diabetes).

Table 2: Comparison of Intraoperative Parameters

Parameter	DLT Group (n=50)	SLT+BB Group (n=50)	p-value
Intubation Time (minutes)	5.2 ± 1.5	7.4 ± 2.1	0.001
Oxygenation (PaO2 mmHg)	180 ± 20	182 ± 18	0.32
Lung Collapse Time (minutes)	3.5 ± 1.2	4.0 ± 1.5	0.21
Hemodynamic Stability	Stable (92%)	Stable (90%)	0.72

Table 2 shows intraoperative parameters, including intubation time, oxygenation, and lung collapse time. The DLT group had significantly faster intubation compared to SLT+BB ($p = 0.001$), while oxygenation and hemodynamic stability remained similar between the groups.

Table 3: Postoperative Complications and Recovery

Complication	DLT Group (n=50)	SLT+BB Group (n=50)	p-value
Sore Throat	24%	10%	0.04
Airway Irritation	10%	4%	0.14
Tube Displacement	6%	14%	0.09
Postoperative Recovery Time (hours)	18 ± 5	12 ± 4	0.03

Table 3 compares postoperative complications and recovery time. The DLT group had a higher incidence of sore throat ($p = 0.04$), whereas the SLT+BB group had more frequent tube displacements ($p = 0.09$). The SLT+BB group also had a significantly shorter postoperative recovery time ($p = 0.03$).

Table 4: Statistical Comparison of Key Outcomes

Outcome	DLT Group (n=50)	SLT+BB Group (n=50)	p-value
Intubation Time (minutes)	5.2 ± 1.5	7.4 ± 2.1	0.001
Sore Throat (%)	24%	10%	0.04
Tube Displacement (%)	6%	14%	0.09
Postoperative Recovery (hours)	18 ± 5	12 ± 4	0.03
Oxygenation (PaO2 mmHg)	180 ± 20	182 ± 18	0.32

Table 4 presents the statistical comparison of key outcomes between DLT and SLT+BB groups. Significant differences were observed in intubation time, sore throat incidence, and postoperative recovery, with p-values of 0.001, 0.04, and 0.03, respectively.

Discussion

We found that the two methods yielded suitable lung isolation during one lung ventilation (OLV) in thoracic surgery, but interesting patterns were seen in the intubation time, airway complications, and postoperative recovery [11]. Our results are consistent with and build on recent findings comparing the two strategies of airway management [12].In line with what has been previously written, however, DLT is a popular criterion in meeting OLV because of its structural design, where it can be ventilated and suctioned independently via two lumens, where it can collapse at a rapid rate, and where it stays in place once it is in place. Recent reviews of the educational literature confirm the speed of insertion and lower probability of intraoperative displacement of the DLTs in comparison with the BBs, as well as the influence on their status as the modality of choice in thoracic anesthesia in the case of normal airway anatomy [13]. Our study showed considerably reduced intubation time in the use of DLT- an outcome that was also reflected in meta-analytic results that revealed that the time taken in the procedure is often the same, but experienced clinicians often take a shorter duration to securely place a DLT [14]. In spite of this, the difference in oxygenation and hemodynamic stability was not found to be significant among the groups, implying that once lung isolation has been achieved, the two devices are both functional in maintaining the relevant physiological parameters during surgery [15].The higher rate of sore throat in the DLT group supports the previous meta-analyses that indicate that the use of BB is linked to lower incidences of postoperative airway irritation, vocal cord damage, and mucosal damage [16]. Xiang and colleagues also did not find the quality of lung collapse to differ between patients treated with BBs and DLT, but found a far lower occurrence of postoperative sore throat with the former technique, which, again, supports our results of the comfort benefit with the latter [17]. Interestingly, the currently conducted study has shown that device movement is more likely with BBs, and it can be complemented by the evidence that in case of confronting lung manipulations, repositioning the patient, or extended surgeries, the latter has significantly higher malposition rates and is prone to frequent intraoperative adjustments [18]. These inclinations may exasperate surgical and anesthetic crews, which indicates restrictions of certain BB designs in being able to sustain isolation without repositioning [19].Our findings resonate with the emergent evidence, which indicates that newer designs of the blocker (i.e., EZ Blocker) can alleviate the risk of malposition by adding features that enhance stability, but no proof has been established that the designs are, in fact, superior to standard BB models. Furthermore, propensity-matched studies based on population clinical data give disparate results on the purpose of postoperative morbidity, with some reporting that there are no differences between the results of DLT and BB, and others finding some protection of BB against pneumonia and hypoxemia. These inconsistent findings point to the importance of taking caution when interpreting the airway device selection based on patient features, procedure type, and clinical experience [20,21].In comparison to the study published over the last five years, our results confirm a more subtle perspective: DLT can be more efficient with respect to procedures and more reliable with respect to lung collapse, whereas BB can have a concrete positive effect on the overall benefits of fewer patient sufferings and even a decreased number of airway injuries. Also, the recent studies point out that BBs can be specifically useful when patients have hard-to-clear airways or expected requirements of postoperative ventilation, since they avoid the need to exchange tubes [22]. Nevertheless, several limitations exist in study. Heterogeneity in trial designs, operator experience, and evaluated BB technologies tends to dilute the quality of evidence. Also, although there are numerous recent study studies on intraoperative parameters, fewer studies assess the long-term outcomes of postoperative pulmonary complications, the ICU length of stay, or patient-reported outcomes with high rigor, which can be addressed in future studies [23]. Finally, our study validates and extends the recent literature since we compare the use of DLT vs. SLT+BB in a randomized cohort systematically [24]. The results support the further use of DLT as the criterion of regular OLV but indicate

significant advantages of BB in the prevention of certain complications and improved comfort in the postoperative period, which allows basing the choice of a device on clinical conditions and patient characteristics [25].

Limitations

The limitations of this study are the single-center type of study, which might impose a limitation on the generalizability of the findings. Besides, patient heterogeneity and experience variability of anesthesiologists may influence outcomes. The limited follow-up (short) and postoperative data on complications such as pneumonia or ICU stay also limit the scope of the study.

Conclusion

Single Lumen Tube with Bronchial Blocker (SLT+BB) as well as Double Lumen Tube (DLT) can both be used in one- lung ventilation in thoracic surgery. DLT is quicker in intubation and provides superior lung isolation at the expense of increased complications. SLT+BB reduces the number of complications and quickens postoperative recovery; it is a good alternative.

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Authors Contributions

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