بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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جامعة عين شمس

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Single Lung Ventilation versus Two Lung Ventilation in Video Assisted Thoracoscopic Lung Surgeries

Thesis

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in Anesthesiology, Intensive Care and Pain Management

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Esraa Abd EL-Latif

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List of Abbreviations

Abb.	Full term
AECs	Airway exchange catheters
ALI	Acute lung injury
ARDS	Acute respiratory distress syndrome
ASA	American Society of Anesthesiologists
CNS	Central nervous system
CO2	Carbon dioxide
COPD	Chronic obstructive pulmonary disease
CPAP	Continuous positive airway pressure
DLTs	Double-lumen endobronchial tubes
EBTs	Endobronchial tubes
ETT	Endotracheal tube
FEV1	Forced expiratory volume
Fio2	Fraction of inspired oxygen
FOB	Fibre-optic bronchoscope
FRC	Functional residual capacity
Hb	Hemoglobin
HFJV	High-frequency jet ventilation
HPV	Hypoxic pulmonary vasoconstriction
HPV	Hypoxic pulmonary vasoconstriction
I:E	Inspiratory to expiratory
ICU	Intensive care unit
LIP	Lower inflection point
N_2O	Nitrous oxide
NANC	Non-adrenergic, non-cholinergic
NO	Nitric oxide
NO	Nitric Oxide

List of Abbreviations Cont...

Abb.	Full term
OLV	One-lung ventilation
Pa	Pulmonary arterial
PAO2	Oxygen partial pressure
PCA	Patient-controlled analgesia
PCV	Pressure-controlled ventilation
PE	Pulmonary embolism
PEEP	Positive end-expiratory pressure
PPCs	Postoperative pulmonary complications
PPV	Positive pressure ventilation
PV	Pulmonary venous
PvO2	Venous oxygen tension
PVR	Pulmonary vascular resistance
RUL	Right upper lobe
RV/TLC	Right ventricular/total lung capacity
SAR	Slowly adapting stretch receptors
TIVA	Total intravenous anesthesia
TLV	Two-lung ventilation
V/Q	Ventilation to perfusion
VATS	Video assisted thoracic surgery
VCV	Volume control ventilation
VIP	Vasoactive intestinal peptide
VT	Tidal volume

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INTRODUCTION

Single lung ventilation is a technique commonly used in thoracic anesthesia to make thoracic surgery easier. It is used to create an optimum operative field and to improve surgical exposure. Single lung ventilation can be accomplished using different tools. However, double-lumen tubes are still considered the most popular and reliable choice for single lung ventilation in adult patients ***(Brodsky & Lemmens, 2003; Della Rocca et al., 2013).*** The use of video-assisted thoracoscopic surgery has become widespread, and the traditional open thoracotomy has been replaced by video-assisted thoracoscopic surgeries due to its minimal invasiveness and associated low morbidity ***(Torresini et al., 2001).*** No single method of lung isolation can be considered to be the best. The use varies according to the situation and has to be decided on *'as and when'* basis. However, ***Alsharani and Eldawlatly in 2014*** described an algorithm for this**.**

Hypoxemia is used to be the primary concern during one lung ventilation. However, hypoxemia has become less frequent due to more effective lung isolation techniques, particularly the routine use of fiberoptic bronchoscopy, and the use of anesthetic agents with little or no detrimental effects on hypoxic pulmonary vasoconstriction. Acute lung injury has replaced hypoxia as the chief concern associated with one lung ventilation ***(Lohser, 2008).*** Nevertheless, it is not surprising that the rate of hypoxemia during single-lung ventilation is higher than 1.9% which is hypoxemia rate, reported for a general surgical collective ***(Morkane et al., 2018).***

Single lung ventilation creates intrapulmonary shunt that can result in a relevant hypoxemia in up to 10% of the procedures, which could be defined as a decrease in arterial oxygen saturation of the patient blood below 90% while being ventilated with an inspiratory oxygen fraction equal or greater than 0.5 ***(Karzai & Schwarzkopf, 2009; Campos & Feider, 2018).*** The treatments of choice are either to re-inflate the operated lung or to raise the inspiratory oxygen fraction of the ventilated lung towards 1.0. However, intra-procedural re-inflation of the operated lung impairs the access for the surgeon to the operational field and may reduce the success of surgery, which is the main drawback of two lung ventilation and that makes the single lung ventilation of choice. Alternative or rather supplemental approaches either intermittent positive airway pressure ***(Russell, 2011)*** or differential lung ventilation can be applied to the dependent lung ***(Kremer et al., 2019).*** Though, excessively the raising of intraoperative inspiratory oxygen fraction with the intention to treat hypoxemia means to replace one evil by another. Oxygen is a powerful vasoconstrictor and the paradoxical situation may arise so that hyperoxia (increased arterial oxygen partial pressure) leads to a reduced oxygen delivery to the vascular beds of various organs, especially of the brain or heart ***(Brugniaux et al., 2018).***

The increase of perioperative oxygen stress is furthermore caused by the generation of reactive oxygen species and leads to molecular, cell, and organ damage ***(Roberts &Cios, 2019).*** However, it has been argued that reactive oxygen species are not bad as a matter of principle but can be