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MANAGEMENT OF PATHOLOGICAL CONDITIONS INDUCED BY MECHANICAL VENTILATION

An Essay submitted for Partial Fulfillment of Master Degree
In Intensive Care

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CONTENTS

Introduction ……	**1**
Aim of the work…….……	**4**
Physiology of Pulmonary Ventilation……...	**5**
Modes of Mechanical Ventilation and Its Complications……	**23**
Prevention of Mechanical Ventilation Complications……...……	**82**
Management of Mechanical Ventilation Complications…...…...…	**95**
Summary and Conclusions…..……...……	**108**
References……...……	**113**
Arabic summary……	

IN THE NAME OF ALLAH THE COMPASSIONATE, THE MERCIFUL

"And say (O' my lord) advance me in knowledge" (Sura Taha 114)

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List of abbreviations

(A/C).....Assist-control ventilation.

(APRV).....airway pressure release ventilation.

(AMV).……. Assisted mechanical ventilation.

(ARDS)…… acute respiratory distress syndrome.

(ATS).....American Thoracic Society.

(BAL) .....bronchoalveolar lavage.

(BVV).....Biologically variable ventilation.

(*CIM*).....critical illness myopathy.

(CINMA) .....critical illness neuromuscular abnormality.

(CMV)……..... Controlled-mechanical ventilation.

(*CO*) .....cardiac output.

(COPD) ……. chronic obstructive pulmonary disease.

(CPAP). Spontaneous continuous positive airway pressure.

(CPIS).....clinical pulmonary infection score.

(C_{RS})..... respiratory-system compliance.

(CT)..... Computed Tomography.

(DO_2) .....oxygen delivery.

(ERV).....The expiratory reserve volume.

(ETT)……..…… endotracheal tube.

(FRC) ……..…….. The functional residual capacity.

(GI) ..... Gastrointestinal.

(HAP).....Hospital acquired pneumonia .

(HCAP)..... Heath care associated pneumonia.

(HFOV)..…..…..... High frequency oscillatory ventilation.

(IC).....The inspiratory capacity.

(ICP).....intracranial pressure.

(ICU) …… the intensive care unit.

(IMV)…….. Intermittent mandatory ventilation.

(IRV)……. The inspiratory reserve volume.

(IV).....Intravenous.

(LTMV).....long-term mechanical ventilation.

(MRSA) .....Methicillin-resistant *Staphylococcus aureus*.

(MV)..... ……Minute volume.

(NIV) …….…… Non-invasive ventilation.

(NMB) ….....…...……..……...Neuromuscular bloker.

(NPPV)…..…… non-invasive positive pressure ventilation.

(PAV).....Proportional assist ventilation.

(P_{aw}) ..... airway pressure.

(PCV)…… Pressure-controlled ventilation.

(PC-IRV)..… pressure-controlled inverse-ratio ventilation.

(PEEP) .....positive end-expiratory pressure.

(PIP)..... Peak Inspiratory Pressures.

(*PNCI*)…….…… polyneuropathy of critical illness.

(PSV)…….……. Pressure support ventilation.

(PTX)…….……..… Pneumothorax.

(QEA) ..... quantitative-culture of endotracheal aspirate.

(RAP)……right atrial pressur.

(RR)……..…… respiratory rate.

(RV).… .....The residual volume.

(SENIC) study on the efficacy of the nosocomial infection control.

(SIMV). Synchronized intermittent mandatory ventilation.

(SIRS).....Systemic Inflammatory Response Syndrome.

(TLC)…….…….. The total lung capacity .

(UTI).....Urinary Tract Infection.

(V_A) ..... volume of alveolar ventilation/minute.

(VAIs)…… ventilator assisted individuals.

(VALI)……..... Ventilator-associated lung injury.

(VAP).....Ventilator-associated pneumonia.

(VC)..... The vital capacity.

(V_D).....dead space air.

(V_E).....the total volume of expired air.

(VILI).....ventilation-induced lung injury.

(V_T) ……..……..... The tidal volume.

(Vi)…….…..…inspiratory flow rate.

(WOB)..... Work of breathing.

List of figures

Fig. No	Tittle	Page
Fig. (1)	***Expansion of the thoracic cage during expiration and inspiration.***	**6**
Fig. (2)	***Changes in lung volume, alveolar pressure, pleural pressure, and transpulmonary pressure during normal breathing.***	**9**
Fig. (3)	***Compliance diagram in a healthy person.***	**11**
Fig.(4)	**Spirometer.**	**15**
Fig.(5)	***Diagram showing respiratory excursions during normal breathing and during maximal inspiration and maximal expiration.***	**16**
Fig.(6)	***Record of the changes in nitrogen concentration in the expired air after a single previous inspiration of pure oxygen.***	**20**
Fig.(7)	***(VA)/perfusion (Q) (VA/Q) abnormalities***	**24**
Fig.(8)	***ventilation (VA)/perfusion (Q) (VA/Q) abnormalities.***	**26**

Fig.(9)	***Mechanical ventilatory airway pressure patterns.***	**27**
Fig.(10)	***Flow and volume starvation during low V_T ventilation.***	**31**
Fig.(11)	***SIMV and auto-triggering during apnea.***	**35**
Fig.(12)	***PSV is patient triggered, pressure controlled, and is generally flow cycled.***	**38**
Fig.(13)	***Pressure-controlled mechanical ventilation rapidly achieves a fixed pressure throughout the breath by delivering a decelerating inspiratory flow pattern.***	**40**
Fig.(14)	***Work imposed by spontaneous continuous positive airway pressure (CPAP).***	**43**
Fig.(15)	***Airway pressure release ventilation (APRV).***	**45**
Fig.(16)	***Tidal volume, flow, airway, esophageal, and transdiaphragmatic pressure tracings.***	**49**
Fig.(17)	***Acute and chronic complications of mechanical ventilation.***	**51**
Fig.(18)	***Pneumomediastinum, pneumoperitoneum, and subcutaneous emphysema.***	**53**
Fig.(19)	***Tension pneumothorax.***	**56**
Fig.(20)	***Pneumomediastinum.***	**57**
Fig.(21)	***Atelectotrauma.***	**61**

Fig.(22)	***Pulmonary pressure-volume relation of a patient with acute lung injury.***	**64**
Fig.(23)	***Causes of respiratory muscular dysfunction.***	**77**
Fig.(24)	***Mechanical ventilation as a cause of multiple organ failure.***	**81**

List of tables

Table No.	Tittle	Page
Table (1)	**Predispositions to barotraumas.**	**54**
Table (2)	**Causes of pneumothorax (PTX) in the ICU settings.**	**55**
Table (3)	**Components of ventilator-associated lung injury.**	**62**
Table (4)	***Upper airway complications related to prolonged ETT and tracheostomy.***	**66**
Table (5)	***GI complications of mechanical ventilation.***	**76**
Table (6)	***Neuromuscular disorders that cause muscle dysfunction in the ICU.***	**79**
Table (7)	***Preventative strategies available in ICU.***	**80**
Table (8)	***Clinical Pulmonary Infection Score.***	**99**

Table (9)	***Routine care of patients suspected of having VAP.***	**100**
Table (10)	***Evaluation for infectious (other than VAP) and noninfectious causes of fever.***	**100**
Table (11)	***High probability of VAP.***	**101**

INTRODUCTION

Mechanical ventilation is one of the life support procedures closely associated with the development of modern Intensive Care Medicine. Although mechanical ventilation is a life-saving intervention for patients suffering from acute respiratory failure, it is associated with numerous grave complications and should be discontinued at earliest possible time **(Bilan et al., 2009)**.

The indications for mechanical ventilation, rather than acute respiratory failure are, coma , acute exacerbation of chronic obstructive pulmonary disease , neuromuscular disorders, and other disorders including; acute respiratory distress syndrome, heart failure, pneumonia, sepsis, complications of surgery, and trauma. The objectives of mechanical ventilation are primarily to decrease the work of breathing and reverse life-threatening hypoxemia or acute progressive respiratory acidosis **(Bilan et al., 2009).**

The most serious potential complication of mechanical ventilation is ventilation-induced lung injury (VILI). VILI was, for years, synonymous with clinical barotrauma, the leakage of air due to disruption of the airspace wall. The extra-alveolar accumulation of air causes several manifestations of which the most threatening is tension pneumothorax **(Han et al., 2005).**

However, mechanical force-induced signal transduction (mechano-transduction) is responsible for many physiological processes in lung development in maintaining lung functions and in pathological conditions related to lung disease, such as asthma, chronic obstructive pulmonary disease (COPD), and acute respiratory distress syndrome (ARDS), especially related to VILI. However, many signal transduction pathways are shared by both the injury and repair processes **(Han et al., 2005).**

On other hand, acute lung injury and its more severe manifestation, ARDS, continue to represent significant clinical challenges with mortality rates of about 60%. Treatment in this patient population remains largely supportive, with mechanical ventilation until the acute insult subsides. Although necessary, positive pressure mechanical ventilation has been implicated as a cause of secondary lung injury acting to exacerbate the primary lung injury. Three main mechanisms of VILI have been postulated; volutrauma, or alveolar over-distension**,** atelectrauma or repetitive shear stresses of the alveolar epithelium caused by unstable alveoli recruiting, and derecruiting, and biotrauma, or inflammation secondary to the mechanical injury induced by volutrauma and atelectrauma. Ventilator-associated pneumonia (VAP) is a major infectious complication in critically ill patients in terms of its incidence and associated mortality and morbidity **(Aarts et al., 2008).**