Iatrogenic Complications in Intensive Care Unit

Essay

Submitted for the partial fulfillment of Master Degree in Intensive Care

By

Abd El-kariem Ahmed Tag El-Dien Amer

M.B, B.Ch.

Under supervision of

Prof. Ayman Mokhtar Kamaly

Professor of Anesthesiology , Intensive Care and pain medicine

Faculty of Medicine, Ain Shams University

Dr. Hadeel Magdy Abdel Hamied

Assistant Professor of Anesthesiology, Intensive Care and pain medicine

Faculty of Medicine, Ain Shams University

Dr. Mohamed Sayed Shorbagy

Lecture of Anesthesiology, Intensive Care and pain medicine

Faculty of Medicine, Ain Shams University

Faculty of Medicine

Ain Shams University

2016

المضاعفات ذات المنشأ العلاجي في وحدة الرعاية المركزة

رسالة مقدمة

توطئة للحصول على درجة ماجستير

الرعاية المركزة

من

الطبيب/ عبدالكريم أحمد تاج الدين عامر

بكالريوس الطب و الجراحه

تحت إشراف

الأستاذ الدكتور/ أيمن مختار كمالي

أستاذ التخدير والرعاية المركزة وعلاج الألم

كلية الطب- جامعة عين شمس

الدكتورة/هديل مجدي عبدالحميد

أستاذ مساعد التخدير والرعاية المركزة وعلاج الألم

كلية الطب- جامعة عين شمس

الدكتور/محمد سيد شوربجي

مدرس التخدير والرعاية المركزة وعلاج الألم

كلية الطب- جامعة عين شمس

كلية الطب

جامعة عين شمس

٢٠١٦

Acknowledgement

*First and foremost thanks to "**Allah**" for his help to fulfil this work.*

*I would like to express my deepest gratitude to **Prof. Ayman Mokhtar Kamaly,** Professor of Anesthesiology and Intensive Care, Faculty of medicine, Ain Shams University, for his kind guidance and supervision.*

*My thanks to **Dr. Hadeel Magdy Abdel Hamied**, Assistant Professor of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University, for her continuous encouragement & supervision.*

*Last But not least, I am also expressing my warmest thanks to **Dr. Mohamed Sayed Shorbagy**, Lecturer of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University, for his generosity & positive attitude.*

Introduction

The primary goal of intensive care is to prevent mortality in patients with reversible critical illness. Despite efforts to provide the best care, complications may continue to occur in the critically ill patient, either because of the natural course of the disease or after a procedure or institution of a new therapy. **(Hurwitz, 2009)**

Iatrogenic complications are defined as an unexpected adverse condition that occurs as a result of medical care and is independent of the patient's underlying disease. Iatrogenic complications in the ICU are inevitable and often lead to medical emergencies. They may affect the clinical course of patients by increasing morbidity and mortality rates. **(Joseph, 2005)**

Iatrogenic complications are frequent, they are induced by the development of invasive techniques of investigation and monitoring, human errors accounted for the majority of them, and were often associated with high nursing workload. The elderly and the severely ill patients are at greater risk of presenting a major complication. Their pathogenesis is related to the acute disease and the characteristics of the ICU. **(Ksouri et al, 2006)**

Iatrogenic complications have been classified as due to complications of drugs, medical, surgical act, the occurrence of nosocomial infection as an iatrogenic complication has been demonstrated to increase the risk of death in critically ill patients and the incidence of nosocomial infection remains high especially in patients receiving critical care.

Poor staff hygiene is considered to be leading source of infections acquired during hospitalization, Human error followed by machine defects were the most common causes of iatrogenic complications. **(National Nosocomial Infections Surveillance system, 2008)**

Mortality outcome was significantly correlated with the occurrence and the severity of iatrogenic illness. Moreover both mortality and the occurrence of iatrogenic illness were significantly associated with the use of mechanical ventilation, increased bed occupancy rate in the unit, the presence of respiratory disease, prolonged duration of stay in ICU. **(Payen, 2005)**

Improving the quantity and quality of manpower with continuous supervision and proper training together with the frequent examination and assessment of patients is recommended to minimize iatrogenic complications and to improve outcomes in the ICU and better organization of the daily workload, avoidance of invasive monitoring, wherever this is possible, could contribute to decrease iatrogenic complications. **(Ismail and Shedeed, 2012)**

Aim of the work

The aim of this work is to:

» Identify types and severity of common complications of critical care and morbidity of complications associated with medical, human practice, surgical act, the occurrence of nosocomial infection, the use of mechanical ventilation and prolonged duration of stay in ICU.

» Determine possible risk factors and to suggest efficient protective measures for reducing the risk of iatrogenic complications in intensive care unit.

Procedures related Iatrogenic Complications

Intensive Care Unit (ICU) patients often require urgent, high-risk diagnostic and therapeutic procedures. Invasive procedures are frequently performed in critically ill patients. It is important for the operator to be familiar with the specific complications of each procedure, as well as steps to take in order to enhance safety and reduce adverse events. High standards of training and credentialing are crucial to ensure that the ICU physicians are proficient in performing these procedures. **(Phua and wahidi, 2009)**

We discuss the complications associated with:

- Airway & endotracheal intubation.
- Bronchoscopy.
- Tracheostomy.
- Central venous catheter.
- Pulmonary Artery Catheterization (PAC).
- Peripheral Cannulation (arterial & venous).
- Chest Tube.
- Gastrostomy tubes.
- Nasoenteric (Ryle) tube.
- Urinary catheter.
- Lumber aspiration.
- Cardio-pulmonary resuscitation.

1- Airway Management and Endotracheal Intubation

During endotracheal intubation, traumatic injury can occur to any anatomic structure from the lips to the trachea. Possible complications include aspiration, damage to teeth and dental work , corneal abrasions, perforation or laceration of the pharynx, larynx, or trachea, dislocation of an arytenoid cartilage, retropharyngeal perforation; epistaxis; hypoxemia; myocardial ischemia; laryngospasm with non-cardiogenic pulmonary edema; and death. **(Table 1) (Mort, 2004)**

» **Factors implicated in the etiology of complications include**:

1. Tube: size, characteristics of the tube and cuff, tube motion.
2. Trauma during intubation.
3. Duration and route of intubation.
4. Metabolic or nutritional status of the patient.

1) Complications during Intubation:

a) cardiovascular complications can accompany intubation:

1. **Ventricular arrhythmias**: have been reported in 5% to 10% of intubations. Ventricular tachycardia and ventricular fibrillation are uncommon but have been reported. Patients with myocardial ischemia are susceptible to ventricular arrhythmias.
2. **Brady arrhythmias**: caused by stimulation of the laryngeal branches of the vagus nerve.

3. **Hypertension** can occur during intubation. In the patient with myocardial ischemia, short-acting agents to control blood pressure (nitroprusside) and heart rate (esmolol) during intubation may be needed. **(Georgi and Benumof, 2007)**
4. **Hypotension.**

b) Spinal cord injury.

c) Aspiration.

d) Damage to teeth and dental work.

e) Corneal abrasions.

f) Perforation or laceration of Pharynx, Larynx and Trachea.

g) Dislocation of an arytenoid cartilage.

h) Passage of endotracheal tube into cranial vault.

i) Epistaxis.

2) Complications while the Tube is in Place:

a) Microscopic alterations to the surface of the vocal cords can occur within 2 hours after intubation. Evidence of macroscopic damage can occur within 6 hours.

b) The sudden appearance of blood in tracheal secretions suggests **anterior erosion** into overlying vascular structures, and the appearance of gastric contents suggests **posterior erosion** into the esophagus. **(Divatia and Bhowmick. 2005)**

c) **Aspiration.**

d) **Failure to secure the endotracheal tube**: properly or patient agitation can contribute to mechanical damage.

e) **Tracheomalacia and stenosis and damage to the larynx.**

f) **Blockage or kinking of the tube.**

g) **Sinusitis:** the presence of nasally placed endotracheal tubes commonly results in the radiographic appearance of sinus opacification.

h) Unplanned **extubation** and endobronchial intubation are potentially life threatening. **(Divatia and Bhowmick. 2005)**

3) Complications After Extubation:

a) Sore throat occurs after 40% to 100% of intubations. Using a smaller endotracheal tube may decrease the incidence of post extubation sore throat and hoarseness.

b) Ulcerations of the lips, mouth, or pharynx can occur and are more common if the initial intubation was traumatic.

c) Pressure from the endotracheal tube can traumatize the hypoglossal nerve, resulting in numbness of the tongue that can persist for 1 to 2 weeks.

d) Irritation of the larynx appears to be due to local mucosal damage and occurs in as many as 45% of individuals after extubation. **(Blanck, 2004)**

e) Unilateral or bilateral **vocal cord paralysis** is an uncommon but serious complication following extubation.

f) Laryngeal edema accompanies almost all endotracheal intubations.

g) Laryngeal ulcerations are commonly observed after extubation. They are more commonly located at the posterior portion of the vocal cords and increasingly common the longer the tube is left in place. **(Jaber et al, 2006)**

h) Laryngeal granulomas and **synechiae** of the vocal cords are extremely rare, but these complications can seriously compromise airway patency.

i) Tracheal stenosis: This occurs much less frequently now that high-volume, low-pressure cuffs are routinely used.

Table 1: complications of endotracheal intubation (Blanck, 2004)

Complications during intubations
Damage to lips
Damage to teeth
Aspiration into the lungs
Hypotension (systolic BP <90mmHg)
Premature ventricular contraction
Bradycardia
Complications while the endotracheal tube was in place
Blockage of endotracheal tube
Inadvertent extubation
Endobronchial intubation
Complications 6 hours post-extubation
Sore throat
Ulceration of mouth/lips
Striodor/laryngeal oedema
Vocal cord palsy
Tongue numbness

4) Drugs used during intubation :

In order to achieve a successful intubation, various classes of medications are needed to achieve specific pharmacologic effects. These effects include providing sedation, analgesia from pain, amnestic effects, anesthesia, anticholinergic effects to control secretions, and paralysis.

Intubation, when performed using the rapid sequence intubation (RSI) protocol, is typically discussed in several stages. The medication described below has specific side effects that occur during endotracheal intubation. **(Table 2) (Reynolds & Heffner, 2005)**

Table 2: Drugs used during intubation. (Reynolds & Heffner, 2005)

Drugs	Side effects	
Propofol	• Hypotension • Bradycardia • Apnoea	• Pain on injection • Fat overload • Convulsions & myoclonic movements
Midazolam	• Hypotension. • Residual and prolonged sedation • Respiratory depression and apnoea	
Thiopental	• Hypersensitivity reactions • Coughing, laryngospasm • Bronchospasm (histamine release) • Respiratory depression and apnoea	• Hypotension,myocardial depression • Tachycardia, arrhythmias • Tissue necrosis from extravasation
Ketamine	• nausea, vomiting; • tachycardia, hypertension, arrhythmias, hypotension, • bradycardia; • apnoea and respiratory depression	• hypersalivation, • laryngospasm; • anxiety, • insomnia; • diplopia, nystagmus, • rash;
Etomidate	• Adrenal insufficiency. • Pain on injection. • nausea, vomiting؛ • hypotension; • apnoea, hyperventilation, stridor; • Hypersalivation	• Arrhythmia • hiccups, cough • cardiac arrest • respiratory depression • seizures • Stevens-Johnson syndrome
Muscle relaxants	▪ Hyperkalemia. ▪ Increased intragastric pressure.	Increased intracranial pressure.

2- Bronchoscopy

Flexible fiberoptic bronchoscopy (FFB) has become an indispensable tool in the optimal management of intensive care unit (ICU) patients with both diagnostic and therapeutic goals. Its safety and usefulness, in well trained hands with appropriate precautions, have led to its increasing use even in unstable and mechanically ventilated patients. **(Lee et al, 2002)**

- ## Complications:

When performed by a trained specialist, routine flexible bronchoscopy is extremely safe. The rare deaths have been due to excessive premedication or topical anesthesia, respiratory arrest from hemorrhage, laryngospasm, or bronchospasm, and cardiac arrest from acute myocardial infarction.

Nonfatal complications occurring within 24 hours of the procedure include fever, pneumonia, vasovagal reactions, laryngospasm and bronchospasm, cardiac arrhythmias, pneumothorax, anesthesia-related problems, and aphonia. **(Table 3) (Jolliet, 2002)**

1. Hypoxaemia:

Hypoxaemia is commonly seen during bronchoscopy, commencing with administration of sedation and worsening on passage through the vocal cords.

Patient positioning and intra-procedural sampling may also influence oxygen saturations as may airway suctioning. The mechanisms causing hypoxia include ventilation-perfusion imbalance and hypoventilation secondary to sedation. **(Van Zwam et al. 2010)**

Ventilation perfusion mismatch may occur as a result of partial airway obstruction caused by the bronchoscope, suction, and due to anesthetic solutions or lavage fluid in the alveoli. Stridor can occur during the procedure and may lead to serious hypoxemia. Monitoring patients with pulse oximetry during bronchoscopy is an accurate non-invasive method for assessing hypoxemia. **(Yildiz, et al, 2002)**

2. Cardiac Arrhythmias and MI:

Arrhythmias and cardiac arrest have been described during fiber optic bronchoscopy. Bronchoscopy was associated with sinus tachycardia in 55–58%, sinus bradycardia in 5–8%, premature ventricular contraction in 8% and atrial premature contraction in 3–5%, with no significant difference according to oxygen supplementation, occasional atrial or ventricular ectopic beat before the procedure, during or after bronchoscopy. Hypoxia at the end of the procedure correlated with occurrence of major arrhythmias. Acute MI is considered a contraindication to bronchoscopy within 4–6 weeks. **(Osula et al, 2003)**