



PATIENT SAFETY AND QUALITY ASSURANCE IN ANESTHESIA

Essay

*Submitted for Partial Fulfillment of Master
Degree in Anesthesia*

By

Ibrahim Mohamed Nour el Din Hussein Mazyona

M.B.,B.Ch

Faculty of Medicine, Ain Shams University

Under Supervision of

Prof. Dr. Samia Ibrahim Sharaf

*Professor of Anesthesia, Intensive Care and pain management
Faculty of Medicine - Ain Shams University*

Assist. Prof. Dr. Adel Mohamad Alansary

*Assistant Professor of Anesthesia, Intensive Care, and Pain Management
Faculty of Medicine - Ain Shams University*

Dr. Yasser Ahmed Abdelrahman

*Lecturer of Anesthesia, Intensive Care and Pain Management
Faculty of Medicine - Ain Shams University*



**Faculty of Medicine
Ain Shams University
2015-2016**

وَأَنْزَلَ اللَّهُ عَلَيْكَ
الْكِتَابَ وَالْحِكْمَةَ
وَعَلَّمَكَ مَا لَمْ تَكُنْ
تَعْلَمُ وَكَانَ فَضْلُ
اللَّهِ عَلَيْكَ عَظِيمًا

صدق الله العظيم

سورة النساء الآية (١١٢)



*First and above all thanks to **ALLAH**.*

*I would like to express my endless gratitude and appreciation to my eminent professor, **Prof. Dr. Samia Ibrahim Sharaf**, Professor in the Department of Anesthesia, Intensive Care unit , and pain management, Faculty of Medicine - Ain Shams University, for giving me the honor to work under her supervision and from whom I did learn a lot. She encouraged me, removed all the obstacles from my way and pushed me to achieve success.*

*My sincere thanks to **Assist. Prof. Dr. Adel Mohamad Alansary**, Assistant Professor in the Department of Anesthesia, Intensive Care Unit, and Pain Management, Faculty of Medicine - Ain Shams University, for his continuous guidance, honest help and endurance that made this thesis come to light.*

*I would also like to express my gratefulness to **Dr. Yasser Ahmed Abdelrahman**, Lecturer in the Department of Anesthesia, Intensive Care Unit and Pain Management, Faculty of Medicine - Ain Shams University, for his precious advice and support throughout this whole work.*

✍ Ibrahim Mohamed Nour el Din Hussein Mazyona

List of Contents

<i>Title</i>	<i>Page No.</i>
List of Abbreviations	ii
List of Tables	iii
List of Figures	iv
List of Algorithms.....	vi
Chapter (1): Introduction and Aim of the Work	1
Chapter (2): Factors threatening patient safety in O.R.	5
Chapter (3): General safety strategies	25
Chapter (4): Standards for basic anesthetic monitoring.....	54
Chapter (5): Methods of patient safety and implementing quality assurance	61
Chapter (6): Guidelines for action after an adverse anesthesia event	96
Conclusion	101
Summary	103
References	113
Arabic Summary.....	--

List of Abbreviations

AAGBI	Association of anesthetists in Great Britain and Ireland
ANZCA	Australian and New Zealand college of anesthesiology
APSF	Anesthesia patient safety foundation
ASA	American association of anesthesiology
BCSH	British society for hematology
CAS	Canadian anesthesiologists society
CSA	Canadian standards association
CT	Clotting time
EBA	European board of anesthesia
EBL	Estimated blood loss
ECRI	Emergency care research institute
EPF	European patients federation
ESA	European society of Anesthesiology
EXTEM	Extrinsically activated thromboelastometry test with tissue factor
FDA	Food and drug administration
FFP	Fresh Frozen Plasma
FIBTEM	Fibrin based extrinsically activated thrombo-elastometry tests with tissue factor and platelet inhibitor cytochalasin D
GA	General anesthesia
HCAI	Health Care associated infections
INR	International Normalized Ratio
INTEM	Intrinsically activated thromboelastometry tests with ellagic acid
IOM	institute of medicine

List of Abbreviations (Cont...)

MI	Myocardial infarction
NCEPOD	The National confidential enquiry into peri-operative death
NHS	National health services
NPO	Nil per Os
NQF	National Quality Forum in the United States
OR	Operating room
PACU	Post anesthesia care unit
PMH	Past medical history
PONV	Post-operative Nausea and vomiting
ROTEM	Rational thromboelastometry
RSS	Ramsey Sedation Scale
TIVA	Total intravenous anesthesia
UO	Urinary output
WFSA	World federation of societies of anesthesiology
WHO	World Health organization

List of Tables

<i>Table No.</i>	<i>Title</i>	<i>Page No.</i>
Table (1):	Latent risk factors	5
Table (2):	Categorization of the cause of morbidity and mortality	6
Table (3):	Definitions of complications involving anaesthesia	9
Table (4):	Edwards Classification of the Relation of Anaesthesia to Operative Morbidity and Mortality Cases	10
Table (5):	The incidence of the 10 most common causes of intraoperative cardiac arrest attributable to anaesthesia.....	12
Table (6):	Contributing factors for the total of 56 mortality and morbidity reports from July 2009 to August 2012 in Ain Shams university	23
Table (7):	Guide to Infrastructure, Supplies and Anaesthesia Standards at Three Levels of Health Care Facility Infrastructure and Supplies.....	29
Table (8):	Suggested indications for specific tests	34
Table (9):	The ASA classification.	35
Table (10):	The following is an example of a checklist for the emergency management of severe or massive intraoperative bleeding.....	85
Table (11):	Options for fibrinogen replacement	86

List of Figures

<i>Fig. No.</i>	<i>Title</i>	<i>Page No.</i>
Fig. (1):	Pre-anaesthetic checklist	38
Fig. (2):	The 2009 Safe Surgery Checklist	39
Fig. (3):	Handover checklist recommendations	42
Fig. (4):	PACU handoff checklist	53
Fig. (5):	Checklist for Anaesthetic Equipment 2012	66
Fig. (6):	Syringe labelling colour code	68
Fig. (7):	Adverse events of local anaesthetic toxicity.	79
Fig. (8):	A pictorial reference range to aid visual estimation of blood loss.....	84

List of Algorithms

<i>No.</i>	<i>Title</i>	<i>Page No.</i>
Algorithm (1):	Difficult / failed intubation algorithm.....	70
Algorithm (2):	Failed intubation in obstetrics	73
Algorithm (3):	Management of patient with suspected bronchospasm during general anaesthesia.	74
Algorithm (4):	Management of hypoxia during anaesthesia.....	75
Algorithm (5):	Guidelines for the management of Malignant Hyperthermia.....	76
Algorithm (6):	Management of patient with suspected anaphylaxis during anaesthesia.....	78
Algorithm (7):	Guidelines for the management of local anaesthetic toxicity	81
Algorithm (8):	For management of high regional block in obstetrics	82
Algorithm (9):	For the management of major haemorrhage	83

Chapter 1

INTRODUCTION

A patient undergoing surgery is always at risk during the procedure, either from direct human errors (anaesthetists or surgeons), mechanical error (malfunction or failure), or adverse effects of the anaesthetic drugs used.

Anaesthetic drugs in itself do have several adverse effects on the cardiovascular and respiratory systems. Furthermore an unconscious patient is at risk of airway obstruction, aspiration and peripheral injury. The use of muscle paralyzing drugs necessitates the dependence on mechanical ventilators for oxygenation which are also prone to malfunctions.

Human errors due to anaesthetists could arise during the deliberate alteration of normal physiological function, or by ventilating for instance only one lung.

Therefore the state of anaesthesia could be considered intrinsically unsafe (*Aitkenhead, 2005*).

As a response, Patient safety has become an issue in all health serving countries. Acknowledging the fact that patient injury could result from not just the misuse of equipments and drugs but also from human errors which could be easily avoided

like lack of communication between health providers and delays in receiving treatments.

A recent WHO study of the developing world showed that:

1. Medications used: 25% unsafe or counterfeit.
2. Hospital medical equipments: atleast half unusable or partly unusable at any given time.
3. Hospital facility: 40% of beds are located in areas not suitable for health services (built for other purpose)

This makes the implementation of infection control and radiation control in such facilities difficult to implement, with the result that such facilities are often either substandard or absent. This can be avoided by implementing the patient safety programmes which do not involve financial resources, but rather the commitment of individuals to practise safely (*Chan et al., 2011*).

Importance of Safety Guidelines:-

According to the National Quality Forum in the united states (NQF) evidence-based, high-priority Safety guidelines are sought to:

1. Promote greater awareness of practices known to improve patient safety.
2. Stimulate widespread implementation of the practices across the continuum of care.

3. Would make it easier for health care providers to benchmark patient safety practices in their particular care settings.
4. Layout accepted infrastructure measures for different health care providing facilities, either primary, secondary or tertiary.
5. Help reduce Human errors.

Safety guideline protocols must first meet criteria, before being adopted by the organisations and implemented, these criteria includes:

- **Specificity:** The practice must be a clearly and precisely defined process or manner of providing a health care service.
- **Evidence of effectiveness:** There must be clear evidence that the practice is effective in reducing the risk of harm resulting from the processes, systems, or environments of care.
- **Benefit:** Even if the practice has evidence of effectiveness, there also must be reason to expect that there would be a benefit if the practice were more widely used.
- **Generalizability:** The Safe Practice is usable in multiple clinical care settings (e.g., a variety of inpatient and/or outpatient settings) and/or for multiple types of patients.
- **Readiness:** The necessary technology and appropriately skilled staff are available to most health care organizations (*Blum and Kizer, 2005*).

Aim of the Work

To highlight the importance of safety guidelines in providing general safety strategies and to identify the methods of improving quality and patient safety.

Chapter 2

FACTORS THREATENING PATIENT SAFETY IN THE OR

There are many factors affecting patient safety due to anesthesia, resulting in either cases of morbidities or mortalities. The following table demonstrates a brief insight on some of these factors, followed by a detailed discussion on the incidence of mortalities and morbidities due to Anaesthesia.

Table (1): Latent risk factors (*Beuzekom, 2010*).

Factor	Cause	Strategy
Equipment	■ Design flaw ■ User error ■ Malfunction	■ pre-use checkout ■ Training for machines. ■ Oxygen supply. ■ A backup oxygen tank. ■ Never shut down audible alarms. ■ Emergency ventilation equipment.
Patient	■ Underlying diseases: hyperthyroidism-thyroid storm, diabetes-ketoacidosis or hyperosmolar coma ■ Allergic reaction to some drug	■ Preoperative evaluations
Anaesthetists and Surgeons.	■ Human factors affecting performance such as: fatigue, noise, boredom, long hours, hunger, tension. ■ Deviations from accepted anesthesia practices. ■ A lapse in vigilance and no attention to detail	■ Adequate staffing, skills ■ Work-directed communication, openness, interrelation, atmosphere ■ Training for procedures. ■ Teamwork and team training. ■ Team performance ■ Presence of protocols, adherence to protocols. ■ Awareness of present situation, own tasks, and future developments. ■ Balance between goals and safety ■ Process of care and proper follow up.

Latent risks could happen any time peri-operatively, The Australian and new Zealand college of anaesthetists adopted this table of categorisation (**Table 2**) in which causes of morbidities and mortalities are linked to the stage at which they could occur within the Pre – intra or postoperative stages, along with causes contributable to patients medical conditions, lack of anaesthetic advances or organisational reasons.

Table (2): Categorization of the cause of morbidity and mortality (McNicol, 2007):

A. Preoperative	
(i) Assessment	This may involve failure to take an adequate history or perform an adequate examination, or to undertake appropriate investigation or consultation, or make adequate assessment of the volume status of the patient in an emergency. Where this is also a surgical responsibility, the case may be classified in Category 3 above.
(ii) Management	This may involve failure to administer appropriate therapy or resuscitation. Urgency and the responsibility of the surgeon may also modify this classification.
B. Anaesthesia technique	
(i) Choice or application	There is inappropriate choice of technique in circumstances where it is contraindicated, or by the incorrect application of a technique that was correctly chosen.
(ii) Airway maintenance including pulmonary aspiration	There is inappropriate choice of artificial airway or failure to maintain or provide adequate protection of the airway or to recognise misplacement or occlusion of an artificial airway.
(iii) Ventilation	Death or morbidity is caused by failure of ventilation of the lungs for any reason. This would include inadequate ventilator settings, and
	failure to reinstitute proper respiratory support after deliberate hypoventilation (example, bypass).
(iv) Circulatory support	Failure to provide adequate support where there is haemodynamic instability, in particular in relation to techniques involving sympathetic blockade.
C. Anaesthesia drugs	
(i) Selection	Administration of a wrong drug or one that is contraindicated or inappropriate. This would include 'syringe swap' errors.
(ii) Dosage	This may be due to incorrect dosage, absolute or relative to the patient's size, age and condition and, in practice, is usually an overdose.
(iii) Adverse drug reaction	This includes all fatal drug reactions both acute such as anaphylaxis, and the delayed effects of anaesthesia agents such as the volatile agents.
(iv) Inadequate reversal	This would include relaxant, narcotic and tranquillising agents where reversal was indicated.
(v) Incomplete recovery	For example, prolonged coma.
D. Anaesthesia management	
(i) Crisis management	Inadequate management of unexpected occurrences during anaesthesia or in other situations that, if uncorrected, could lead to death or severe injury.
(ii) Inadequate monitoring	Failure to observe minimum standards as enunciated in the ANZCA policy document or to undertake additional monitoring when indicated; for example, use of a pulmonary artery catheter in left ventricular failure.
(iii) Equipment failure	Death or morbidity as a result of failure to check equipment or due to failure of an item of anaesthesia equipment.
(iv) Inadequate resuscitation	Failure to provide adequate resuscitation in an emergency situation.