Ain Shams University

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Awareness and Recall under Anaesthesia

An Essay Submitted For Partial Fulfillment of Master Degree In

Anaesthesiology

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List of Abbreviation

AAI ..... A-line ARX Index

AANA ..... American Association of Nurse Anaesthetists

ACTH…….AdrenoCorticoTrophic Hormone

AER(P) ..... Auditory Evoked Response (Potential)

ANOVA …….. Analysis of Variance

ARX ..... Autoregressive model with an exogenous input

ASA ..... American Society of Anaesthesiologists

ASSR ..... Auditory Steady State Evoked Response

AUC ..... Area Under the Curve

AVP…….. Arginine Vasopressin

BAER ..... Brainstem Auditory-Evoked Response

BDZ ..... Benzodiazepines

BIS ..... Bispectral Index Scale

BSR ..... Burst Suppression Ratio

CER ……. Comparative Effectiveness Research

CNS ..... Central Nervous System

CPB ..... Cardiopulmonary Bypass

CS…… Cesarean Section

CVS..... Cardiovascular System

DoA..... Depth of Anaesthesia

ECG …… Electrocardiogram

EEG ..... Electroencephalogram

EMG …….. Electromyogram

ETT ..... Endotracheal Tube

FDA ..... Food and Drug Administration

GA ..... General Anaesthesia

GH …….. Growth Hormone

HRV ..... Heart rate variability

Hz …….. Hertz (cycle/sec)

ID ……..... Identification

IDT …….. Induction to Delivery Time

IV ……..... Intravenous

JCAHO ..... Joint Commission on Accreditation of Health Care Organization

LTM ..... Long Time Memory

MAC ..... Minimum Alveolar Concentration

MIC …… Monitor Interface Cable

MLAER ..... Middle Latency Auditory Evoked Response

N_2O ..... Nitrous Oxide

P value ……...Propability value

PACU ..... Post Anaesthesia Care Unit

PET ..... Positron Emission Tomography

PIC …….. Patient Interface Cable

PSA ..... Patient State Analyzer

PSI ..... Patient state Index

PTSD ..... Post Traumatic Stress Disorder

RE ..... Response Entropy

SD ..... Standard Deviation

SE ..... State Entropy

SEF ..... Spectral Edge Frequency

SEMG ..... Spontaneous Surface Electromyogram

SLOC ..... Spontaneous Lower Oesophageal Contractility

SPSS ..... Statistical Package for Social Sciences

SQI ..... Signal Quality Indicator

SSER ..... Somatosensory Evoked Response

STM ..... Short Time Memory

TIVA ..... Total Intravenous Anaesthesia

UDT ..... Uterine incision to Delivery Time

US ..... United States

USB .....Universal Serial Bus

VER .....Visual Evoked Responses

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Introduction

Memory is not a single entity, recent classifications distinguish between two types: Explicit, or conscious memory, and implicit, or unconscious memory. Explicit memory refers to the conscious collection of previous experiences. Implicit memory by contrast, refers to changes in performance or behavior that are produced by previous experiences but without any conscious recollection of those experience **(Ghoneim, 2000)**

The term "awareness" during anesthesia, as used in the anesthesia literature, implies that during a period of intended general anesthesia, the brain is aroused by stimuli that are stored in memory for future explicit recall. Patients who experience awareness will recall such experiences during a state of inadequate anesthesia ***(Ghoneimet al, 2009).***

The incidence of awareness in nonobestetric, and noncadiac surgical cases is 0.2%. Yet it may be greater if light anesthesia is used. The incidence in obstetric cases is 0.4%, a higher incidence also has been reported for cardiac cases (ranges from 1.1-1.5%),

and major trauma cases (11-43%). This incidence varies according to the dose of anesthetic administered ***(Ghoneim et al , 2009), (Rampersad&Mulroy, 2005).***

Aim of the work

The aim of the work is to throw light on types, risk factors and complications of Awareness under anaesthesia and discuss what might be done to manage it.

Physiology of memory

Definition of Memory:

Memory is one of the activities of the human mind, much studied by cognitive psychology. It is the capacity to retain an impression of past experiences. It was defined by ***Lefrancois (1995)*** as the availability of information and the ability to retrieve it and the previously acquired skills.

Memory is also defined as a set of active processes that encode and store information and rearrange it with related items which have already been stored in memory, so that it is easier to remember and can be located and retrieved whenever needed ***(Thompson and Kim, 1996).***

So the main stages in the formation and retrieval of memory, are:

- **Encoding** (processing and combination of received information)

- **Storage** (creation of a permanent record of the encoded information)
- **Retrieval** (calling back the stored information in response to some cue for use in some process or activity) ***(Thompson and Kim, 1996).***

Models of Memory:

The concept of **memory** has generated the construction of many models in attempt to explain, understand and interpret its functions ***(Thompson and Kim, 1996).***

A. Atkinson and Shiffrin Model of Memory (Multi-Store Model or Multi-Memory Model):

In *1968, Atkinson and Shiffrin* proposed a model of human memory **(figure1)** which presented two distinct memory stores: **short-term memory(STM)**, and **long-term memory(LTM)**. Later a third memory store (actually the first in sequence) was added; **the sensory memory**. Here are some of the characteristics of each memory system:

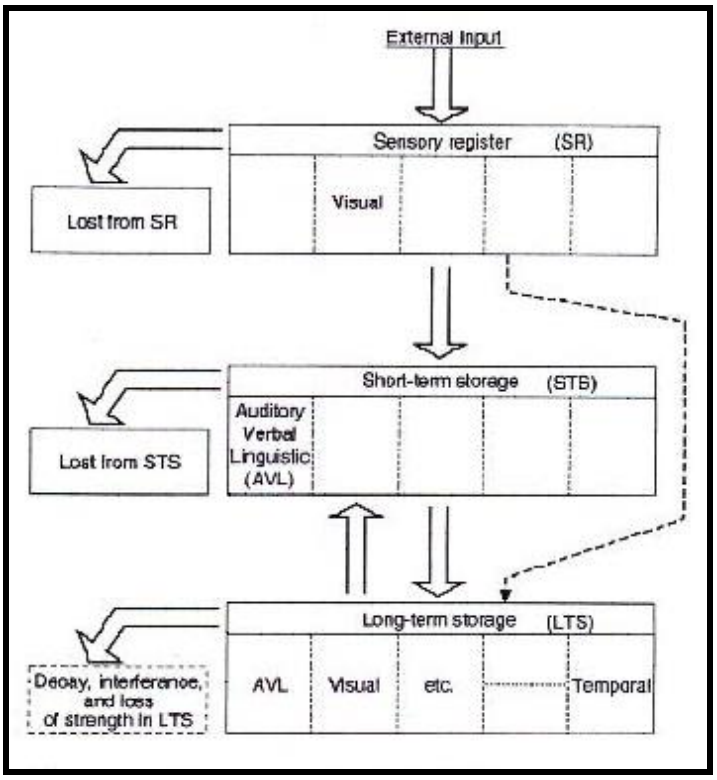

Figure (1): Atkinson-Shiffrin modelof memory. External stimuli enter the sensory memory, of which a portion is transferred into the STM. Small amount of the information then enters into the LTM of which the STM refers back to and expands on when needed ***(Atkinson and Shiffrin, 1968).***