ASSESSMENT AND MEASUREMENT OF ANAESTHETIC DEPTH

E S S A Y
Submitted for Partial Fulfilment of
Master Degree in Anaesthesia

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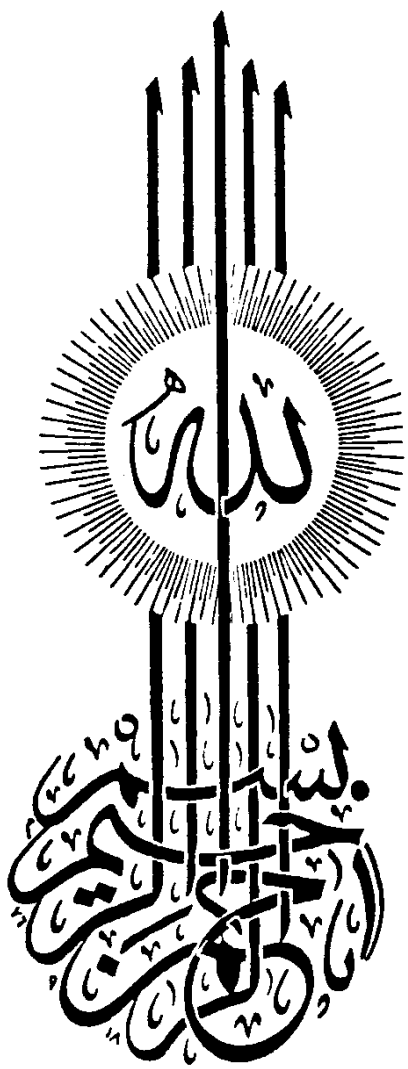

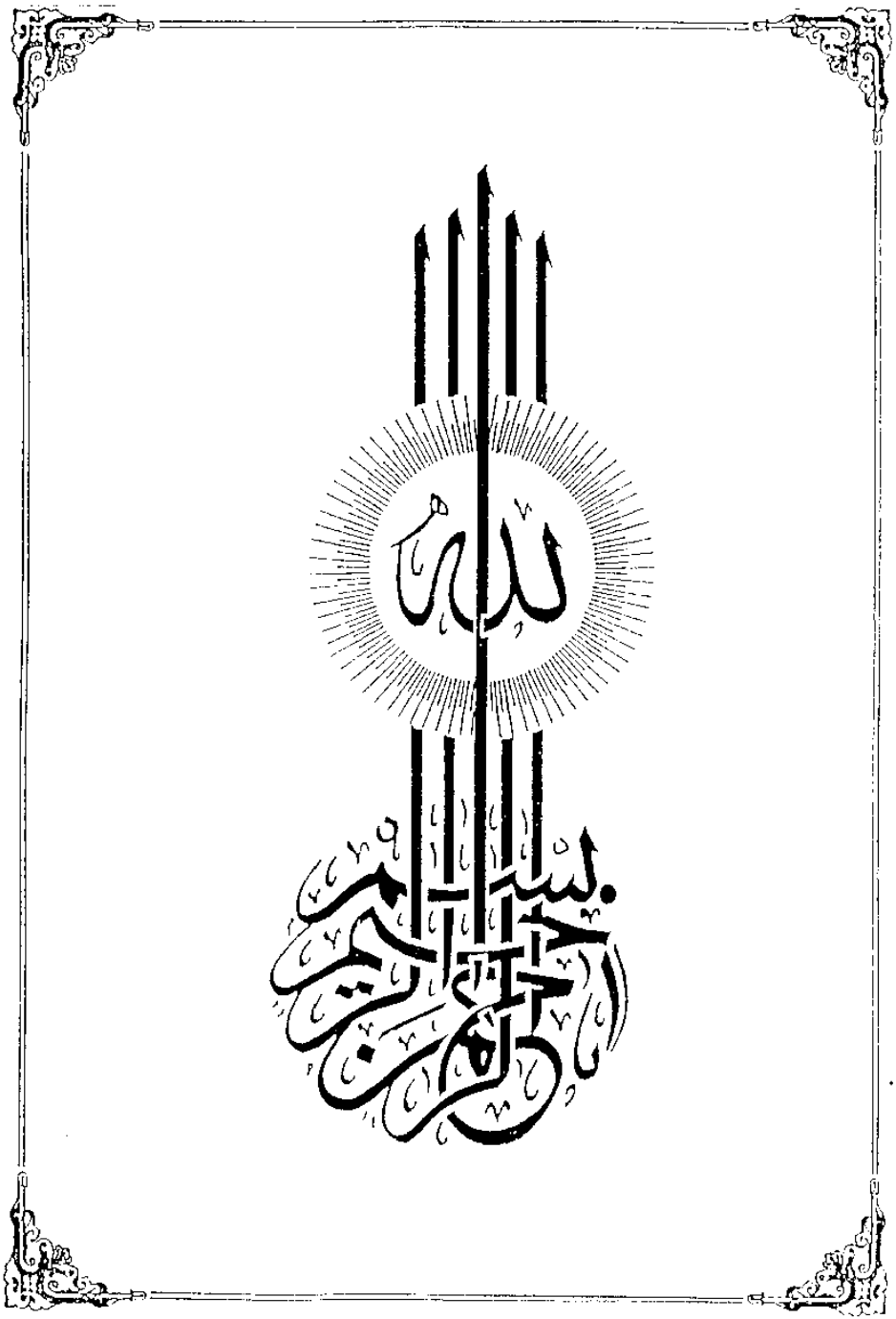

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INTRODUCTION

INTRODUCTION AND HISTORY

General anaesthesia, may be defined as that state in which the body is insensible to pain and possibly to other stimuli as well. For the anaesthetist to detect that the patient feels pain or other sensations, the responses to noxious stimuli must be observed.

Some methods to assess depth of anaesthesia must be introduced. Attempts to assess anaesthestic depth and potency first appeared in **1847** by **John Snow.**

Specific signs of central nervous system depression include abolition of movement in response to surgical stimulation, loss of the righting reflex, attainment of a given level of electroencephalographic suppression and achievement of certain changes in pupillary diameter, eye movement, respiration and muscle tone **(Gillespie, 1943)**.

From the discovery of the first anaesthetic, the need for measurement of anaesthetic depth was apparent. Early concepts for evaluation of anaesthetic depth were skeletal muscle response and autonomic responses "pupillary size, arterial blood pressure, heart rate, sweating, tears" **(Davies, et al., 1982).**

The use of recent, reliable, noninvasive techniques for monitoring anaesthetic depth could increase the precision involved in determining anaesthetic and analgesic dosage requirements.

Improvement in the ability to administer anaesthetics in proper doses as guided by anaesthetic depth monitors would decrease the incidence of side effects both during and after the operative procedure.

Theortically, more precise techniques for administering centrally active drugs during ambulatory (outpatient) anaesthesia might also contribute to a more rapid recovery after surgery.

The aim is to clarify methods of monitoring anaesthetic depth whether clinical or instrumental techniques with special stress on the way to identify sharp method for evaluation of anaesthetic depth.

HISTORY

HISTORY

The word anaesthesia was first used by the Greek Philosopher Discorides to describe the narcotic effect of the plant mandragora. The word re-appeared in the 1771 Encyclopedia Britannica where it was defined as a "privation of the senses" **(White, 1987).**

After introduction of ether anaesthesia by **Morton in 1846, Oliver wendell Holmes** used the word to describe the new phenomenon that made surgical procedures possbile.

Plomley was the first **in 1847**, to define depth of anaesthesia. He described three stages:
Intoxication, excitement "both conscious and unconscious" and deeper levels of narcosis.

In the same year, **John Snow** described "five degrees of narcotism" for ether anaesthesia. The first three stages encompassed induction of anaesthesia; the last two, surgical anaesthesia. Eleven years later, he turned his attention to chloroform **(Snow, 1858).**

Snow's excellent characterization of ether and chloroform anaesthesia, described the conjunctival reflex, regular, deep, automatic breathing; movement of the eye

balls; and inhibition of the intercostal muscles. Many of these clinical signs were later rediscovered **(Gillespie, 1943)**. As oxygen was not readily available until the early **1900s**, **Snow** and his successors tried to minimize the use of deep anaesthesia to decrease morbidity and mortality.

Premedication with sedatives or opioids was introduced in the early nineteenth century. Also, anaesthetics with more rapid onset, such as nitrous oxide and ethylene, became available. Therefore, the anaesthetic excitement phase could be traversed more rapidly with the use of preanaesthetic medication and inhaled anaesthetic with a rapid onset of action:

In 1937, Guedel published his classic description of the clinical signs of ether anaesthesia. He used clear physical signs involving somatic muscle tone, respiratory patterns and ocular signs to define four stages.

First Stage "analgesia" is characterized by slow regular breathing using both the diaphragm and intercostal muscles and by the presence of the eye lid reflex, the patient experiences complete amnesia, analgesia and sedation.

Second stage "delirium" the patient experiences excitement, unconsciousness and a dream state with uninhibited activity. Ventilation is irregular and unpredictalbe. Reflex

dilatation of the pupils occurs, the lid relfex is intact, and the risk of clinically important reflex activity (e.g., Vomiting, laryngospasm on arrhythmias) increases.

Third stage "Surgical anaesthesia"; consists of four progressive planes:

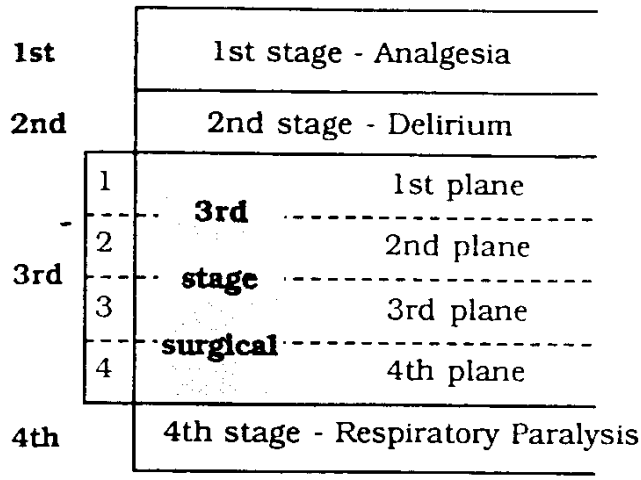
Plane 1: is characterized by slight somatic relaxation; regular periodic breathing, and active ocular muscles.

Plane 2: Breathing changes, inhalation becomes briefer than exhalation;and a slight pause separates inhalation and exhalation. The eyes become immobile.

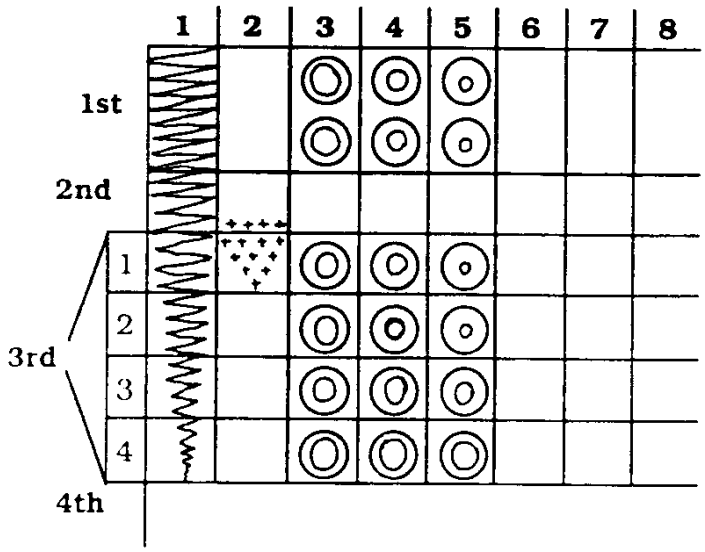
Plane 3: the abdominal muscles are completely relaxed, and diaphragmatic breathing is very Prominent. The eye lid reflex is absent.

Plane 4: the intercostal muscles are completely paralysed, and paradoxical rib cage movement occurs.Breathing is irregular and pupils are dilated.

In Guedel's fourth stage "Respiratory paralysis"; muscles become flaccid and eyes widely dilated. Respiratory and later cardiovasular arrest occur.



A
showing division of anaesthesia into four stages and the division of the third or surgical stage into four planes.



B
Column 1. Respiration
Column 2. Eyeball activity
Column 3,4,5. Pupils
Column 6. Eyelid reflex
Column 7. Area of swallowing
Column 8. Area of vomiting

Guedel's classic text described the stages and planes of ether anaesthesia (A) and then related them to clinical signs or relevant reflexes (B).(Guedel. 1937)

In 1954, Artusio expanded **Guedel's** description of ether analgesia (Stage 1) into three planes.

In plane 1: the patient has no amnesia or analgesia.

In plane 2: the patient has total amnesia and partial anaglesia.

In plane 3: the patient has complete analgesia and amnesia, but is comfortable and responsive to verbal stimulation; there is little depression of reflexes.

The clinical signs of depth of anaesthesia defined by **Guedel** and others has significant practical utility for the administration of ether, cyclopropane and chloroform anaesthesia. with the beginning of 1942, small doses of the muscle relaxant d-tubocurarine were used with the deeper levels of ether anaesthesia that produced plane 2 or 3 of Guedel's stage III. Respiration was assisted when necessary to overcome undue respiratory depression when the dose of d-tubocurarine was increased fully controlled ventilation became mandatory. Anaesthesiologists soon realized that they could combine controlled ventilation and large doses of muscle relaxants with low concentrations of inhaled anaesthetics to reduce the risk of toxicity "cardiovaascular and respiratory depression" and increase the speed of

emergence from anaesthesia. However, the use of muscle relaxants eliminated two valuable types of clinical signs of anaesthetic depth; the rate and the volume of respiration and the degree of muscle relaxation induced by the anaesthetic **(Robson, 1969).**

In 1945 Editors in the Lancet Magazine discussed the clinical problems that muscle relaxants would create, and description of patients awareness during surgery later began to appear in the literatures.

In 1957, Wood Bridge defined anaesthesia as having four components:

1. Sensory blockade of afferent nerve impulses.
2. Motor blockade of efferent impulses.
3. Reflex blockade of the respiratory, cardio vascular or gastero intestinal tract. and
4. mental block, sleep or unconsciousness.

Different drugs could be used to achieve each effect. However, **Wood Bridge** made no effect to define methods of assessing each of these components.

Pinsker;(1986) described anaesthesia as a broad descriptive term. Anaesthesia has three components paralysis, unconsciousness and attenuation of the stress response. Any