Ain Shams University
Faculty of Medicine
Department of Anesthesiology
Intensive Care and Pain Management

Anesthetic Considerations In Acute Traumatic Head Injury

Essay protocol submitted for partial fulfillment
Of Master Degree of Anesthesia
By

Hend Yousef Ahmed Al Shiha (*M.B.B. Ch.*)

Supervision by

Prof. Dr. Gehan Fouad Kamel Youssef

Professor of Anesthesiology and intensive care
Faculty of Medicine
Ain Shams University

Dr. Wael Ahmed Mohamed Abd El-Aal

Assistant professor of Anesthesiology and intensive care
Faculty of Medicine
Ain Shams University

Dr.Mohamed Sayed Shorbagy

Lecturer of Anesthesiology and intensive care
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University
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Hend Yousef Al Shiha

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ACA	Anterior cerebral artery
ARDS	Acute respiratory distress syndrome
ASA	American Society of Anaesthesiology
ATLS	Advanced trauma life support
AVDO2	Arterio-venous difference of oxygen
BBB	Blood-brain barrier
CBF	Cerebral blood flow
CMRO2	Cerebral metabolic rate for oxygen
CNS	Central nervous system
CPP	Cerebral perfusion pressure
CSF	Cerebrospinal fluid
CT	Computed tomography
CVP	Central venous pressure
DIC	Disseminated intravascular coagulopathy
DNA	Deoxyribonucleic acid
E	Eye Opening
EEG	Electroencephalogram
FAST	Focused Assessment by Sonography in Trauma
GCS	Glasgow Coma Scale
GSCs	Glasgow Coma Scale score
H2O2	Hydrogen peroxide
HES	Hydroxyethyl starch
ICAs	Internal carotid arteries

ICP	Intracranial pressure
IJV	Internal jugular vein
INR	International Normalized Ratio
LMAs	Laryngeal mask airways
M	Motor Response
MAP	Mean arterial pressure
MCA	Middle cerebral artery
MRI	Magnetic resonance imaging
N_2O	Nitrous oxide
NO	Nitric oxide
O2	Superoxide anion
OH	Hydroxyl free radical
OR	Operating room
PCA	Posterior cerebral arteries
$PtiO_2$	Postoperative brain tissue oxygen tension
SBP	Systolic blood pressure
sICAM	soluble intercellular adhesion molecules
SjO_2	jugular venous bulb oxygen saturation
TBI	Traumatic brain injury
TCD	Transcranial Doppler
V	Verbal Response

INTRODUTION

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Acute head injury usually refers to traumatic brain injury. Traumatic brain injury (TBI) is a major public health problem and the leading cause of death and disability worldwide. Approximately 1.7 million people sustain TBI every year in the United States, leading to 275,000 hospitalizations and 52,000 deaths. TBI is a contributing factor in about 30.5% of all injury related deaths in the United States.TBI occurs most often in children aged 0–4 years, adolescents aged 15–19 years and elderly aged 65 years and more. In all age groups, males have a higher rate of TBI than females. Fall and motor vehicle-traffic injury are the leading causes of TBI in the United States. ***(Faul et al., 2010)*.**

Traumatic brain injury is defined as damage to the brain resulting from external mechanical force, such as rapid acceleration or deceleration, impact, blast waves, or penetration by a projectile. Brain function is temporarily or permanently impaired and structural damage may or may not be detectable with current technology**. *(Maas et al., 2008).***

TBI is usually classified based on severity, anatomical features of the injury, and the mechanism (the causative forces). Mechanism-related classification divides TBI into closed and penetrating head injury. A closed (also called none penetrating or blunt) injury occurs when the brain is not exposed. A penetrating or open head injury occurs when an object pierces the skull and breaches the dura mater, the outermost membrane surrounding the brain. ***(Hannay et al., 2004).***

According to severity, Brain injuries can be classified into mild, moderate, and severe categories. Glasgow Coma Scale (GCS) is the most commonly used system for classifying TBI severity, grades a person's level of consciousness on a scale of 3–15 based on verbal, motor, and eye-opening reactions to stimuli. In general, it is agreed that a TBI with a GCS of 13 or above is mild, 9–12 is moderate, and 8 or below is severe. Although useful in the acute phase, additional modalities such as high resolution computed tomography (CT), and magnetic resonance imaging (MRI) can be used to further classify traumatic brain injury in the acute setting. ***(Duhaime and Saatman, 2008).***

It is important to begin emergency treatment within the so-called "golden hour" following the injury. People with moderate to severe injuries are likely to receive treatment in an intensive care unit followed by a neurosurgical ward. Treatment depends on the recovery stage of the patient. In the acute stage the primary aim of the medical personnel is to stabilize the patient and focus on preventing further injury because little can be done to reverse the initial damage caused by trauma. The primary concerns are ensuring proper oxygen supply, maintaining adequate cerebral blood flow, and intracranial pressure. ***(Parikh et al., 2007).***

Chapter 1

Anatomy of the skull and brain

Anatomy of the skull

The human skull is a bony structure which supports the structures of the face and forms a cavity for the brain. The skull is described as viewed from the above, the front, and the side and from below. ***(John, 2014).***

Superior aspect:

The vault is crossed by three sutures. The coronal suture separates the frontal bone from the two parietal bones. The midline sagittal suture separates the two parietal bones. Its junction with the coronal suture, the bregma, is incompletely ossified at birth and can be felt as a diamond- shaped deficiency known as the anterior fontanel, which closes at 18 months. The lambdoid suture separates the two parietal bones and the occipital bone posteriorly and meets the sagittal suture at the lambda. This is not ossified at birth and presents as a small bony deficiency known as the posterior fontanel, which closes by 3rd to 6th month. ***(John, 2014).***

Lateral aspect:

The zygomatic arch is formed by the zygomatic process of the temporal bone and the temporal process of the zygomatic bone (Figure 1). The masseter muscle arises from the lower border of the arch. Below the temporal line, is the temporal

fossa. Temporalis muscle arises from the inferior temporal line and the whole surface of the temporal fossa. The medial wall of the fossa is formed by the frontal, parietal, temporal and greater wing of the sphenoid bones. Their H-shaped union, the pterion, lies about 3.5 cm behind and1.5 cm above the palpable frontozygomatic suture. Here the middle meningeal artery grooves the inner surface of the bone. A blow to the side of the head may fracture the thin bones of the pterion and rupture the middle meningeal vessels, resulting in extradural haematoma. ***(John, 2014).***

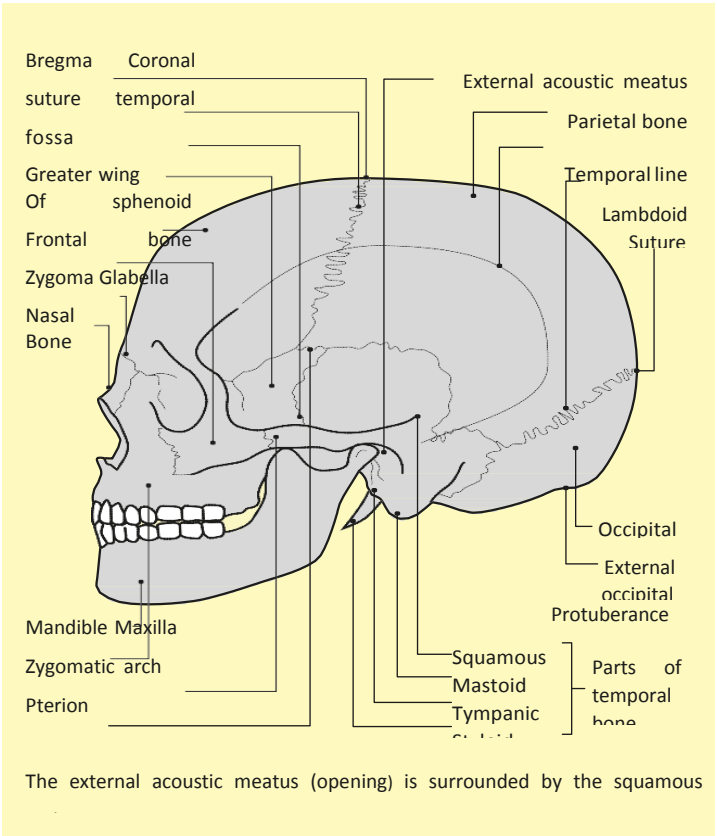

Figure 1: Lateral aspect of the skull. ***(John, 2014)***