COMPLICATIONS OF COMPOUND FRACTURE OF THE SKULL

Thesis

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By

ABD EL-LATIF AHMED MOHAMED

M.B.B.Ch.

Supervisor

Professor Dr. MAMDOUH MOHAMED SALAMA

Professor of Neurosurgery

Ain Shams University

FACULTY OF MEDICINE

AIN SHAMS UNIVERSITY

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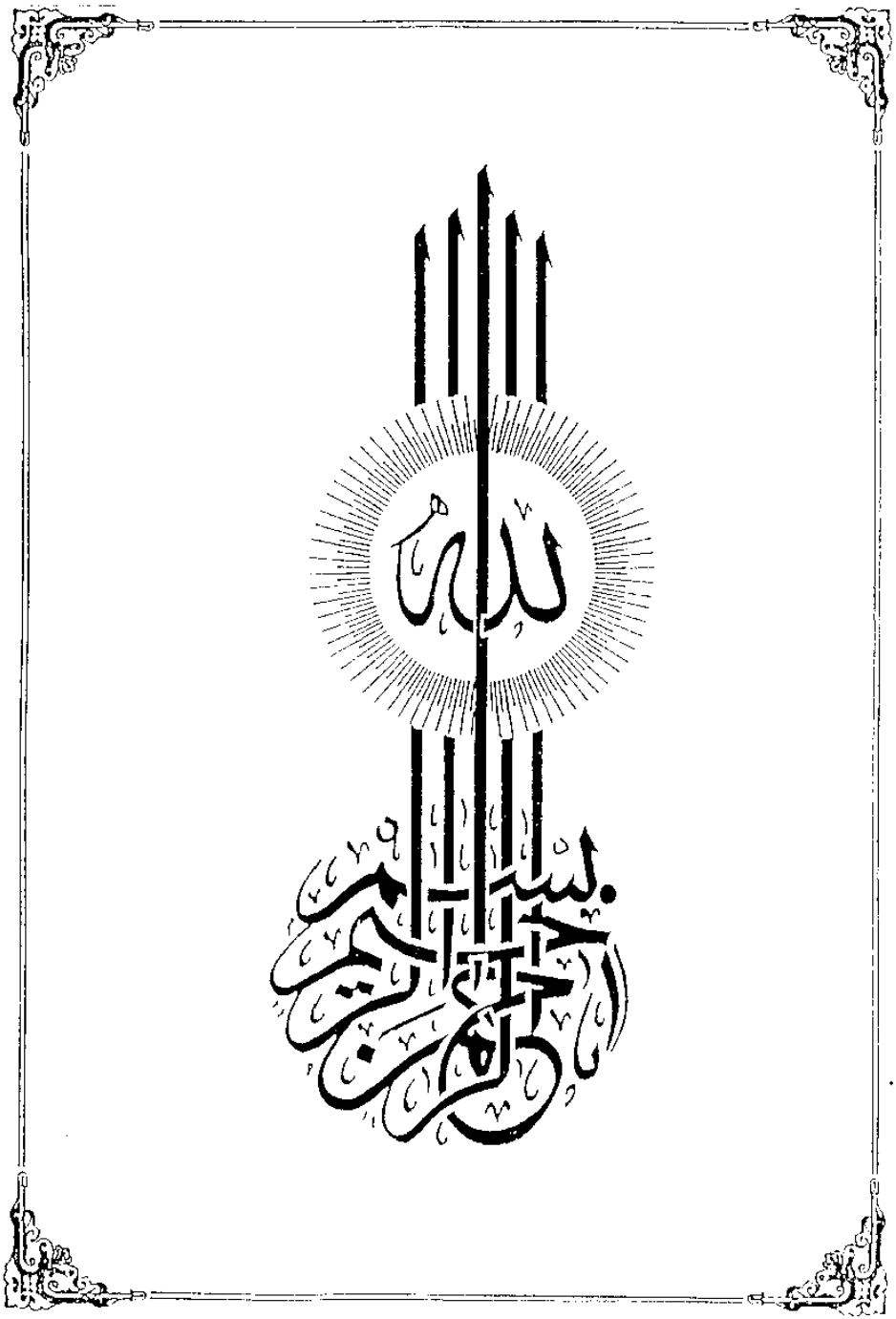
To my wife



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AIM OF WORK

Compound fractures of the skull are attended with high incidence of complications. Many of these complications occur as a result of mismanagement of such injuries. The aim of work is to study the factors that pave the way for the development of such complications and the measures that would minimize its occurrence.

A N A T O M Y

ANATOMY

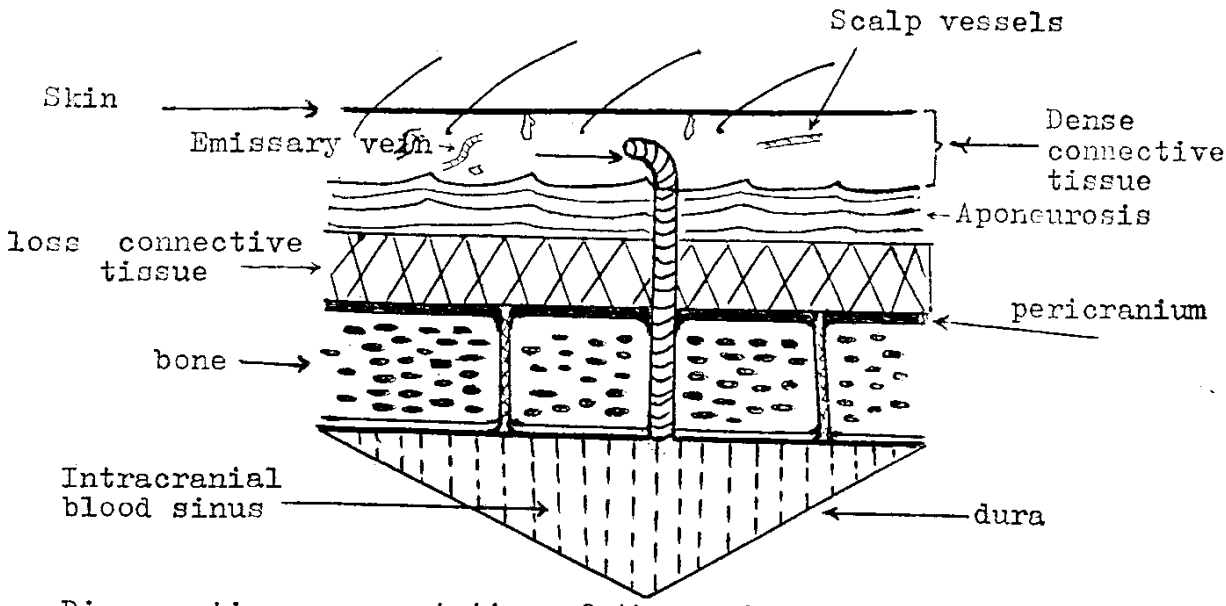
The Scalp: (Romanes, 1967):

The scalp covers the vault of the skull and extends between the right and left temporal lines, and the eye brows and the superior nuchal lines. Essentially it consists of a flat aponeurotic sheet, the eponeurosis, which is the tendon of the two frontal and the two occipital bellies of the occipitofrontalis muscle. To this the skin is bound by dense strands of fibrous tissue which traverse the subcutaneous tissues and split it into a large number of separate pockets filled with fat. It is in this superficial layer that the blood vessels and nerves of the scalp are found. Deep to the aponeurosis is a layer of loose connective tissue which allows it to slide freely on the periosteum covering the skull.

Layers of the Scalp: (Plessis, 1975):

The scalp consists of five layers:

- Skin.
- Connective tissue-dense.
- Aponeurosis of the occipitofrontalis or epicranius muscle.
- Loose connective tissue.
- Pericranium or periosteum.



Diagramatic representation of the anatomy of the scalp.

Skin:

This is denser here than any where else in the body. It contains great numbers of hairs and sebaceous glands. Therefore the scalp is the commonest site for the occurrence of sebaceous cysts.

Dense Connective Tissues:

This layer acts as a very firm bond of union between the skin above it and the epicranius muscle and its aponenrosis (Galea aponeurotica) beneath it. It is very dense and fibrous and contains the nerves and blood vessels of the scalp. The vessel walls are firmly anchored by this connective tissue. For this reason wounds of the scalp bleed profusely as the torn vessels are prevented from retracting. The bleeding, on the other hand, can always be arrested by pressure against the underlying bone.

Subcutaneous haemorrhage into this layer is never extensive, as expansion is limited. Inflammation here also occasions little swelling but much pain, because of the unyielding nature of the stratum.

The blood-supply of the scalp is very profuse. It is therefore hardly ever necessary to cut away partly avulsed portions of scalp, as sufficient blood will enter the flap through the remaining connexions to ensure its vitality.

Aponeurotic Layer:

This is muscular infront and behind. The muscles are connected by the galea aponeurotica or aponeurosis of the occipitofrontalis.

The frontalis has no bony origin. It arises from the skin and subcutaneous tissue in the region of the eyebrow and root of the nose, and blends with the orbicularis oculi. It is inserted into the galea. Its fibres run ventrically and the right and left muscles are in contact by their inner border. In action it causes transverse wrinkling of the brow. Vertical furrous are caused by the contraction of the subjacent corrugator supercilli muscles.

The occipitalis arises from bone. It takes origin from the outer half of the superior nuchal line. The two

muscles are separated by a traingular gap which is filled by an extension of the galea on its way to be attached to the same line.

The galea aponeurotica is a very dense strong membrane. Over the temporal region it becomes much thinner and is attached to the zygomatic arch. Wounds of the scalp do not gape unless the epicranius or galea be divided transversaly as the skin is so firmly united to this structure that only a knife can separate them.

Loose Connective Tissue:

This is very tenuous and delicate. Emissary veins connecting the venous sinuses in the skull with the veins of the scalp traverse this area. It is usually over looked that the vessels and nerves which reach the scalp from the orbit must lie in this layer for a short distance. The first three layers of the scalp can readily be separated from the pericranium through this plane. This layer forms a potential space where blood or pus may collect. Such a collection can extend over the whole dome of the skull, being limited only by the attachments of the epicranius and the galea. It may extend therefore.

Posteriorly - to the superior nuchal line.

Laterally - to the zygomatic arch.

Anteriorly - it may track into the root of the nose and the eyelids because the frontalis has no attachment to bone.

A black eye can be caused in different ways:

1. It is usually due to local violence causing subcutaneous extravasation of blood into the lids. It appears within an hour or so after the receipt of the violence, and the haemorrhage occurs simultaneously in both lids.

2. A black eye may also, however, be due to a blow in the skull causing bleeding into the layer of loose connective tissue. The blood gravitating slowly downwards under the origin of the frontalis appears in the eyelids taking usually a day or two to do so, and being first seen in the upper lid and only later in the lower one.

3. Fractures of the orbital plate of the frontal bone causes haemorrhage into the orbit. The blood tracks forward under the conjunctiva appearing in a triangular shape, the apex being at the margin of the cornea. This so called flame-shaped haemorrhage is to be distinguished from subconjunctival haemorrhage due to local violence to the eyes, by the fact that

in the former the posterior limit of the haemorrhage cannot be seen.

Because of its potential great extent and the presence in it of certain emissary veins, the sub-aponeurotic space is often called "the dangerous area of the scalp". An old surgical axiom states that if it were not for emissary veins, wound of the scalp would lose half their significance.

In children the dura and perioranium are more intimately attached to the skull bones than in the adult. It follows that fractures of the vault may result in tearing of the dura and pericranium so that intracranial haemorrhage may make its way through the line of fracture and collect in the subaponeurotic compartment of the scalp. No signs of compression of the brain develop until the subaponeurotic space is full of blood.

When this happens signs of cerebral compression develop rapidly. Such a collection of blood has been aptly termed a "safety valve" haematoma. Traumatic cephalhydrocele is a rare condition sometimes seen in young children, consisting of a swelling under the scalp made by a collection of cerebrospinal fluid which has escaped via a fracture of the vault associated with tearing of membranes of the brain. It may become tense

when the child cries.

The Pericranium:

Or periosteum of the scalp is but loosely attached to the surface of the skull bones except at the suture lines and over the temporal fossae. At the suture lines it drips in between the adjacent bones as the sutural membrane which is blended with the periosteum of the interior of the skull, which latter is merely the outer layer of the dura.

Over the temporal fossae the pericranium is firmly fixed to the whole floor of the fossae.

Collections of fluid beneath the pericranium can therefore strip it easily but cannot transgress the suture lines. For this reason such a swelling (cephal-haematoma, traumatic cephalhydrocele) will take the shape of the bone to which it is related. The features which distinguish haemorrhages in the different layers of the scalp are of great diagnostic value to the surgeon.

The surgeon does not hesitate to reflect the peri-cranium if necessary, as the skull bones are nourished not only by the periosteum on their inner surface, but also if not mainly, by the vessels which enter at the attachments of muscles to the bones (H.S. Southar). The

big osteoplastic flaps of modern surgery rarely necrose although frequently the only structure left attached to the bone is the insertion of muscles.

Temporal Region:

In this region the scalp consists of the following layers:

1. Skin.
2. Dense connective tissue.
3. Thinned out aponeurosis of the occipitofrontalis and the origin of two of the extrinsic muscles of the ear.
4. Temporal fascia.
5. Temporal muscle.
6. Pericranium.

Temporal Fascia:

This is the only structure to which it is necessary to allude. It is attached to the superior temporal line or crest, while below it splits into two laminae which are attached to the zygomatic arch. It is exceedingly dense, which is under standable if it be remembered that it is morphologically analogous to bone. In the tortoise the temporal fossa is bony tunnel. The practical significance is that wounds of this fascia may be mistaken for wounds of the skull, because of the firmness of the wound edges to the examining finger.