EXTRADURAL HAEMORRHAGE

THESIS

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BY

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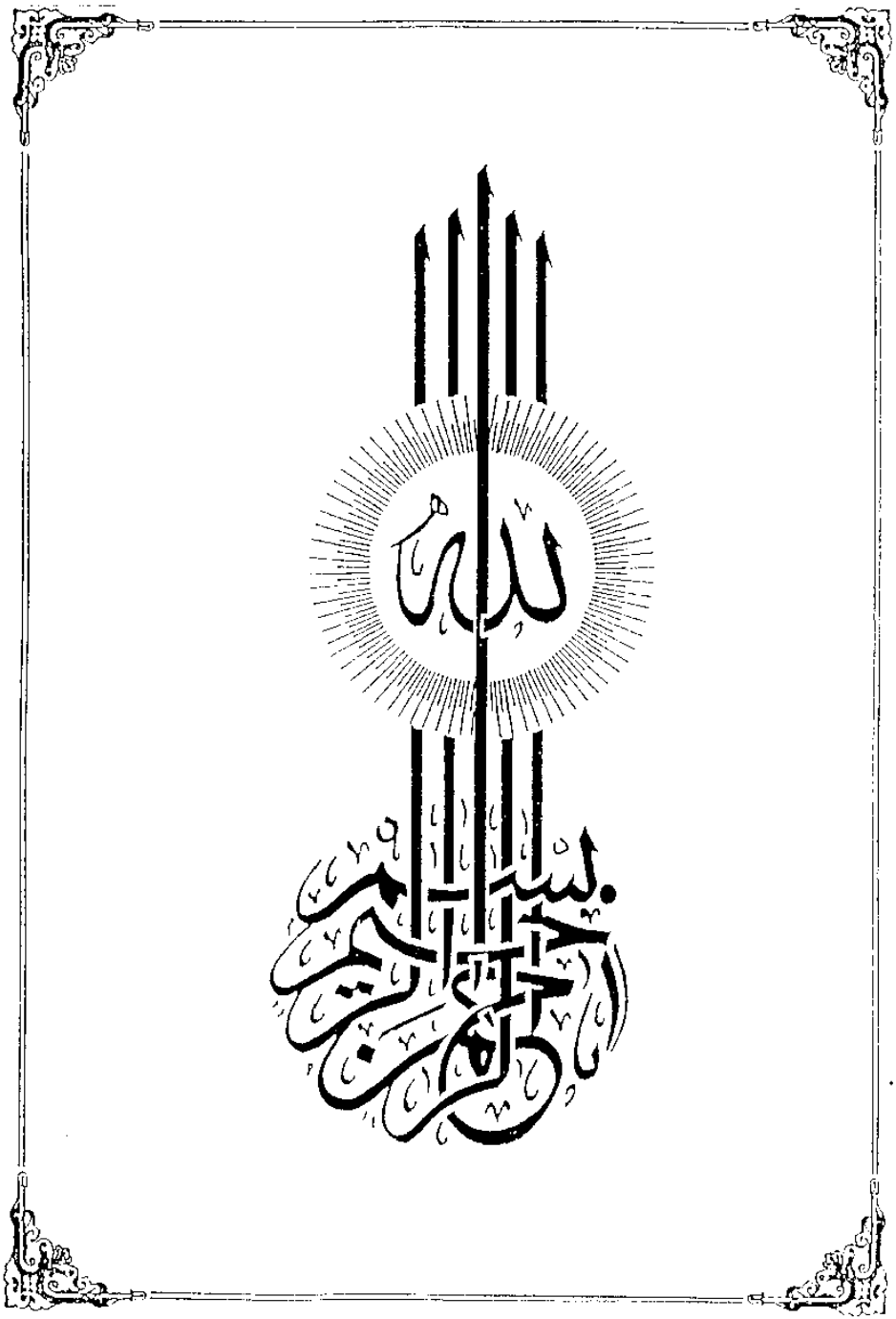

CONTENTS

ANATOMY OF THE SKULL

The skull is the skeleton of the head. It is made up of large number of bones with the exception of the mandible. They are so intimatly connected to one another that no movement is possible between them.

The lines alonge which the individual bones meet one another are termed sutures.

The skull is divided into calvaria and base by a line running from the glabella in front of the external occiptal protuberance. The following skull bones together form the calvarium "The frontal bone, Both the parietals, the squamous portions of temporal bone, the squamous portion of the occipital and the vertical portion of the sphenoid (Davies et al, 1964).

There are considerable difference in thickness between the skull bones at various points thus squamous part of the Temporal and the vertical parts of the sphenoid bones are very thin that the bony surface can be indented by a blunt object without any notable effort (De grood 1975).

In the vault there are vertical thickening at the glabella, external angular processes, mostoid bone,

and external occipital protuberence and these are united by six arches, three on each side : The supra orbital ridge infront, the curved lines of the occiput behind, and temporal crests at the side also there is a strong anteroposterior arch of bone at the top of the skull in the middle line protecting the sagitall sinus (Rowbotham 1954).

The calvarium consists of three lyers of bones. First comes the lamina externa which is a layer of compact bone varing in thickness between 1 - 4 mm this is followed by the layer of spongy bone or diploe consisting of a network of trabeculae in some areas of the skull and in children this spongy layer may be very thin but is always present. The diploe contains a number of small very thin walled veins (venae - diploicae) which in certain areas converge to form large veins visible on radiographs as winding grooves (De grood 1975) these venous network is particulary well developed in infants at the age of two years, these veins communicates with the meningeal veins, the sinuses of the dura mater and the veins of the pericranium.

They comprise, the frontal deploic vein which is confined chiefly to the frontal bone and pierces

the greater wing of sphenoid bone to end in sphenoparietal sinus or in the anterior deep temporal veins. The posterior temporal which is situated in the parietal bone, it descends to the mastoid angle and Joins the transverse sinus through the mastaid foramen, and the occipital diploic vein which is confiend to the occipital bone and opens into the occipital vein or into the transverse sinus near the confluence of the sinuses (Davis et al, 1964).

The inner wall of the calvarium usually show definite impressions of the branches of meningeal arteries.

The skull cap is lined with a fibrous membrane termed the endocranium which is the outer layer of the dura mater.

Anteriorly in the median plane the frontal crest projects Back, it gives attachement to the falix cerebri and grooved by the commencement of the sagittal sulcus which lodges the superior sagittal sinus. On each side of the sagittal sulcus the bone presents a number of irregular depressions which are termed by the arachnoid granulations which are tuft-like protrusions of the arachnoid matter (Davies et al, 1964).

Vascular supply :

Arterial blood is supplied by the external and internal carotid arteries and the vertebral arteries and their branches the venous drainage is accomplished by the cerebral veins functioning as communications between the intracranial and the extracranial venous channels.

Middle meningeal artery and vein :

This artery is a branch of the external carotid through its maxillary branch, it is accompanied by 2 or 3 veins in its intracranial course and supplies the greater part of the dura in the middle $\frac{2}{3}$ of the cranium .

It enters the cranium through the foramen spinosum in about 57 % of cases and either divides into an anterior and posterior branchs immediatly or runs along the greater wing of sphenoid for one inch (Gurdjian et al, 1959). The anterior branch may be given off from the ophthalmic artery, and may then enter the cranial cavity through the superior orbital fissure, in such cases, the foramen spinosum may be absent or it may be a passage of small artery, the

equivelant of the posterior branch (Gurdijan et al, 1959). This fact shows the importance of ligation the turnk and both branches of the middle meningeal artery in cases with epidural haematoma.

The anterior branch crosses up towards the pterion and then curves back and ascends towards the vertex laying over the precenteralgyrus (Last 1973).

It is usually larger than the posterior and appears to be the continuation of the main trunk.

The posterior branch courses horizontally backwards on a groove in the squamous part of the temporal bone and ramifies over the posterior part of the skull. It lies along the superior temporal gyrus. Haemorrhag from the anterior branch causes pressure on the motor area while from the posterior branch may cause contralateral deafness (Last 1973).

In the adult the meningeal artery is partly encased in a groove on the inner surface of the skull

these grooves are absent or are extremly shallow in infants and children (Gurdjan et al., 1959).

The surface markings of the middle meningeal vesseles are important in the matter of trephining for Hage. The artery enters the skull opposite e point immediatly above the middle of the Zygomatic arch and divides opposite a point 2 cm above this arch.

From this point the anterior branch runs first upwards and slightly forwards to the pterion. This point lies 3, 8 cm above the Zygomatic arch 3.5 cm behind frontozygomatic suture and then the anterior branch runs first upwards and backwards the midpoint between the inion and nasion.

The posterior branch runs upwards and backwards towards the lambda (Davies et al, 1964).

The interior of the cranium is lined with the pia matter, between the two, in contact with the dura matter lies a membrane known as arachnoid matter (Last 1973).

Dura Mater :

It is a tough semitranslucent inelastic membrane that serves the two fold purpose of an internal periosteium of bones and a membrane for the protection of the brain, it encloses the venous sinuses and forms partition within the skull.

The dura is closly attached to the interior of the skull for which its outer layer provides an inner periosteum .

The closness of this attachment and difficulty with which the dura is separated from the skull in the adults is responsible for localised lenticle shaped bulging of a Haege between dura and skull (Epidural haematoma).

In contrast a Haege that occurs, beneath the dura (Subdural haematoma) tends to spread widly over the surface of the brain (Commender 1966). Tears in the wall of the dural venous sinuses are nearly always associated with overlying fructures, fortunatly they are rare, this is due to the fact that the large dural channels with the exception of the dessending limbs of the lateral sinuses are not embeded in deep grooves

but run in contact with the flat surface of the skull, so are not necessarily lacerated when the overlying bone is fractured. As the sinus walls are fibrous and rigid then do not collapse or contract when torn as arteries do with the result that bleeding is often profuse in spite of low venous pressure (Rowbotham 1954).

On the base of the skull the fused layers of the dura are so firmly attached in all three cranial fossa that they can stripped away from the bare bone with some difficulty.

One such fold roofs in the posterior cranial fossa forming the tentorium cerebelli another fold forms the falx cerebri, lying in the midline between the two cerebral hemispheres the function of these septa is to minimize rotatory displacement of the brain.

The tentorium cerebelli is a flange of fibrous layer which projects from the margins of the transverse sinuses and the margins of the superior petrosal sinuses. Its anterior free margin is V shaped, the uncus and tip of the temporal lobe may be forced through it as a result of pressure from above (Last 1973).

The dura recieves its blood supply in the middle fossa and parietal areas from the middle meningeal artery (Commander 1966).

In the anterior fossa the dura is supplied by the anterior meningeal and ethmoidal arteries while in the posterior fossa the dura is supplied by the posterior fossa meningeal a branch of occipital artery (Davis et al, 1964).

Arachnoid Mater :

The arachnoid is an impermeable membrane of fibrous tissue it lies in close contact with the fibrous layer of the dura mater in the cranium and spinal cord, the two are separated by a mere film of tissue fluid (Last 1973).

Haemorrhage between these two layers may spread freely limited only by barriers of the falx and tentorium. The cerebral veins which traverse this space on their way to the venous sinuses have little support except that given by the dura and arachnoid thus they are especially suceptable to injury when the brain slides or rotates following

a blow on the skull, this is particulary true when the space between the brain and venous sinuses is increased as is often the case in an alcoholic atrophy of the brain (Commander 1966) bleeding in the subarachinoid space is the most common forme of massive bleeding due to acute cerebral trauma, the bleeding may come from any vessel on any surface of the brain. The blood collects chiefly in the sulci, the cerebro-spinal fluid prevents its clotting. Thus it is carried to all parts of the cerebral and spinal subarachnoid spaces and cisterns.

Extensive intracranial clotting may occur where a large vessel is severed but such occurrences are usually rapidly fatal (Rowbotham 1954) in case of closed linear fracture associated with a tear on the underlying dural and arachnoid membranes, cerebro-spinal fluid escapes into the subgaleal space forming a traumatic meningocele, occuring more commonly in children (Rowbotham 1964).

In certain areas the arachinoid herniates through little holes in the dura mater into the venous sinuses. Such hernia are called arachnoid villi, through their walls the cerebro-spinal fluid (oozes) back into the blood in children the villi are discrete, as are progresses

they become aggregated into visible clumps "called arachnoid granulations (Last 1973).

Pia Mater :

This is a very delicate membrane it invests the brain and spinal cord as periosteum invests bone. It is rich in plexuses of minute vesseles bleeding from these vesseles becomes rapidly mixed with the spinal fluid. This blood if sufficient in quantity may block the outflow of the C.S.F leading to a late hydrocephalus, however it rarly creates a problem in the acute or subacute stages of head injury (Comander 1966).

Blood supply of the dura mater :

The fibrous layer of the dura mater requires very little blood to nourish it the endosteal layer is supplied by the middle meningeal artery and in the anterior cranial fossa by meningial branches of ophthalmic and anterior ethmoidal arteries and over the cavernous sinus by meningeal branches of the internal carotid artery and the accessory meningeal artery. The latter vessel enters the skull from the maxillary artery through the foramen ovale in the posterior fossa by the meningeal branches of the vertebral artery as well as occipital artery given off.