RADIOLOGICAL ASSESSMENT OF CAUSES OF INCREASE BONE DENSITY OF THE BASE OF THE SKULL

THESIS

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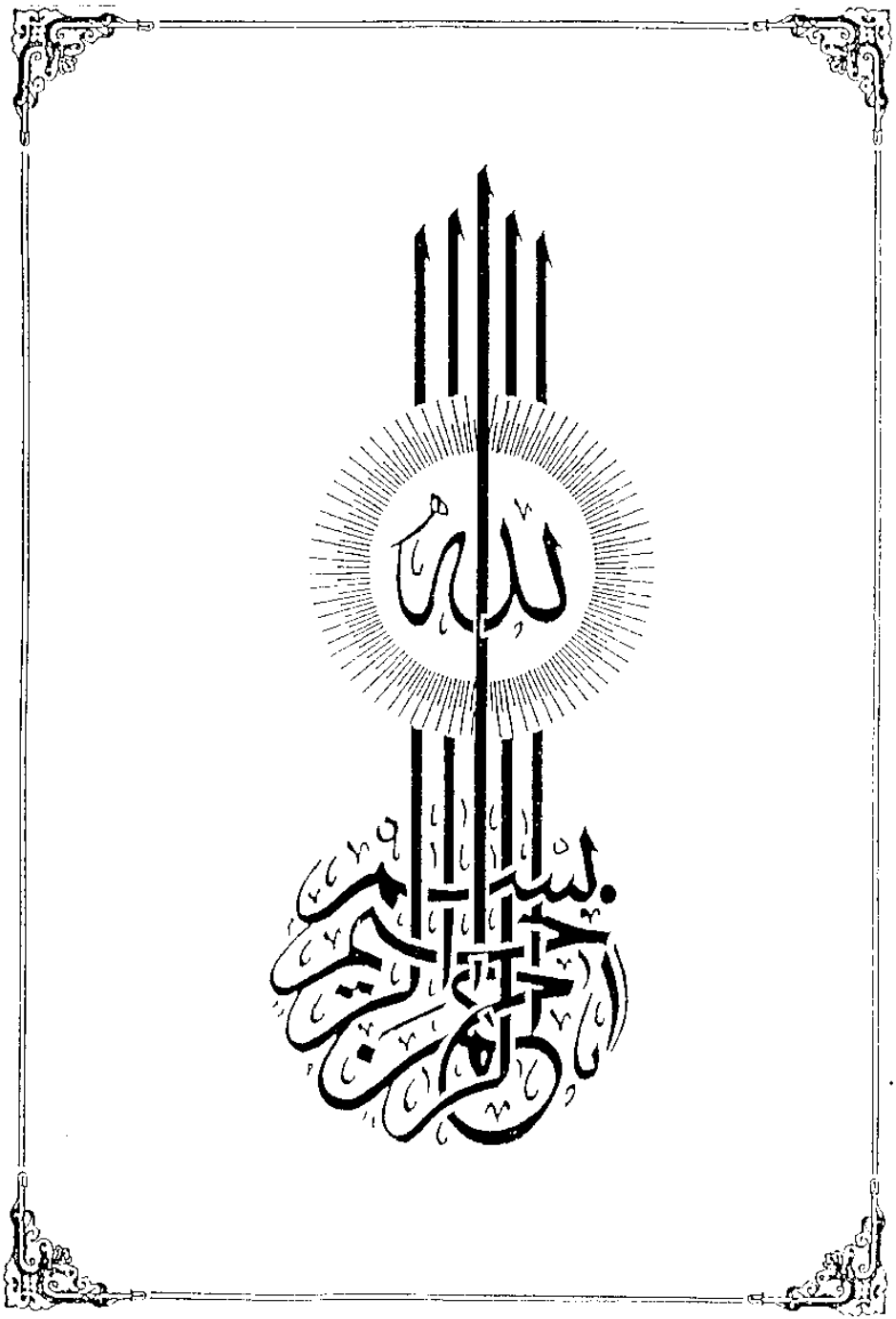

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INTRODUCTION

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Although plain X-ray skull is a very simple procedure which doesn't need special technique or equipments, yet it can give us a clue to the diagnosis of many diseases. Some of these diseases, for example, cause a characteristic feature in the plain films, which is increase bone density of the base of the skull and although this feature is subjective, still we can depend on it in our diagnosis when other features coincide with the disease.

This work is done to demonstrate some of these diseases and their clinical, pathological, and other roentgenographic features which help us to reach a final diagnosis.

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RADIOLOGICAL ANATOMY OF THE BASE OF THE SKULL

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Before one can adequately analyze the anatomy of any structure, it is necessary to have a working knowledge of its embryologic development. There are essentially three mesenchymal divisions in the development of the skull. The first division covers the brain and leptomeninges and later forms the dura mater, calvarium, and scalp, while the second division develops into the face.

The third division, the neurocranium or skull base, provides a floor for the brain and a roof for the face. The condrification of this third division during the second fetal month initiates skull development. Enchondral ossification will later transform this division into the bony chondrocranium. Thus the skull base is the only part of the skull that is performed in cartilage; the first and second mesenchymal divisions are converted directly to bone, resulting in membranous bone formation.

Multiple enchondral ossification sites develop in the chondrocranium of the embryo. They gradually enlarge and unite to form the seven bones of the adult

skull base, which consists of three unpaired bones- the ethmoid, sphenoid, and occipital bones-and two paired bones, the temporal bones and the inferior turbinates. Although the ethmoid and turbinates develop completely from cartilage, the other bones of the skull are partly membranous.

These membranous parts are small in the sphenoid, representing the tips of the greater sphenoid wings and part of the medial ptergoid plates, and also in the occipital bone, where membranous bones forms the portion above the nuchal line. Conversely, the membranous portion of the temporal bone is large and consists of the squamousa, zygomatic process, and annulus, whereas only the petrous pyramid belongs to the chondrocranium [Bergeron, et al., 1984].

[Meschan, and Meschan, 1959] and [Warwick, and Williams,1973] discussed that the base of the skull have two surfaces an exterior surface [norma basalis] and an interior surface.

1. THE EXTERIOR SURFACE [norma basalis] Fig. (/)

The inferior surface of the base of the skull is very irregular. It extends from the incisor teeth of the maxillae, back to the superior nuchal lines of the occipital bone. Laterally are the other teeth, the zygomatic arch and its posterior root, and the mastoid process. It is useful to divide the area into anterior, middle and posterior parts.

Fig. [1] The exterior [inferior] surface of the left half of the base of the skull [Norma basalis] [Quoted from Warwick and Williams, 1973].

A. The anterior part of the norma basalis :

The anterior part, formed by the hard palate and the alveolar arches. The bony palate is formed by the palatine processes of the maxillae and the horizontal plates of the palatine bones . The free border of the bony palate project backwards in the median plane as the posterior nasal spine.

B. The middle part of the norma basalis :

The middle part of the external surface of the base of the skull extends from the posterior border of the bony palate to an arbitary line drawn transversely through the anterior margin of the foramen magnum.

In the median plane anteriorly the posterior border of the vomer separate the two posterior nasal aperatures. Immediately behind the vomer, the posterior part of the inferior surface of the body of the sphenoid is directly continuous with the inferior surface of the basilar part of the occipital bone. The pterygoid process descends behind the third molar tooth from the junction of the greater wing and body of the sphenoid.

The foramen ovale and foramen spinosum are important openings on the infratemporal surface of the greater wing of the sphenoid. The foramen ovale, irregularly

oval, lies close to the upper end of the pos ior margin of the lateral pterygoid plate. It tr its the mandibular division of the trigeminal nerve, the accessory meningeal branch of the internal maxillary artery, and occasionally the middle meningeal veins. Posterior and slightly lateral to the foramen ovale the foramen spinosum pierces the greater wing and transmits the middle meningeal artery, the middle meningeal vein or veins, and the recurrent or meningeal branch of the mandibular nerve. Immediately posterolateral to the foramen spinosum this surface of the greater wing has an irregular downward projection,[the spine of the sphenoid].

The inferior surface of the petrous temporal occupies the interval between the greater wing of the sphenoid and the basilar part of the occipital bone. Its apex is separated from the posterolateral part of the body of the sphenoid by an irregular bony canal, termed the foramen lacerum. The anterior orifice of the carotid canal opens on its posterior wall, and the vessel with its venous and sympathetic plexuses, ascends through the upper end of the foramen. In the foramen the deep petrosal nerve from the carotid sympathetic plexus is joined by the greater petrosal nerve to form the nerve of the pterygoid canal. Meningeal branches of the assending pharyngeal artery and emissary veins from the cavernous

sinus pass right through the foramen. The cartilage which fills its lower part is a remnant of the primitive chondrocranium .

Behind the anterior part of petrous temporal a large and approximately circular foramen, the inferior opening of the carotid canal, occupied by the internal carotid artery. The mandibular fossa contains the head of the mandible when the mouth is closed.

C. The posterior part of the norma basalis :

The median region of the posterior part of the skull base features anteriorly the foramen magnum which leads into the posterior cranial fossa.

The foramen is oval, wider behind than in front, and its anteroposterior measurement exceeds its transverse. It transmits a number of structures. It's wider, posterior part transmits the lower end of the medulla oblongata and the meninges. In the subarachnoid space the spinal roots of the accessory nerves, and the vertebral arteries, with their sympathetic plexuses ascend into the cranium, and the posterior spinal arteries descend, one on each posterolateral aspect of the brainstem, as does the anterior spinal artery on the front of the brainstem, in the median plane. In addition, the lower parts of

the tonsils of the cerebellum may project into the foramen on each side of the medulla oblongata.

Anteriorly the margin of the foramen is overlapped slightly on each side by an occipital condyle, which projects downward to articulate with the superior articular facet on the lateral mass of the atlas. Above the anterior part of the condyle the occipital bone is pierced by the hypoglossal canal, which contains the hypoglossal nerve,a meningeal branch of the ascending pharyngeal artery, and a small emissary vein from the basilar plexus. A depression of variable depth occurs behind the condylar fossa, and may be pierced by the condylar canal which, when present, transmits an emissary vein from the sigmoid sinus.

The jugular foramen is a large irregular hiatus between the occipital bone and the jugular fossa of the petrous temporal, and is set at the posterior end of the petro-occipital suture. The foramen is usually larger on the right side. The anterior part of the foramen transmits the inferior petrosal sinus; its intermediate part, the glossopharyngeal, vagus and accessory nerves; its posterior part, the internal jugular vein. The floor of the jugular fossa separates the superior bulb of the internal jugular vein from the tympanic cavity, and its

lateral wall is pierced by a minute canal, the mastoid canaliculus, which transmits the auricular branch of the vagus nerve.

Posterior to the root of the styloid process the stylomastoid foramen transmits the facial nerve and stylomastoid branch of the posterior auricular artery.

2. THE INTERNAL SURFACE OF THE CRANIAL BASE :Fig.[2]

The internal surface shows a natural division into anterior, middle and posterior cranial fossae. It is very irregular owing, partly, to the impressions for the cerebral gyri.

A. The anterior cranial fossa :

It is limited in front and on each side by the frontal bone. Its floor is formed by the orbital part of the frontal bones, the cribriform plate of the ethmoid, and the lesser wings and anterior part of the body of the sphenoid.

The cribriform plate of the ethmoid, lies between the two orbital parts of the frontal bone. It seprates the fossa from the nasal cavity. Anteriorly it presents a median crest-like elevation, termed the crista galli, which projects upward between the two cerebral hemispheres. Posteriorly the cribrifrom plate articulates with