hossam maghraby

بسم الله الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

hossam maghraby

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

hossam maghraby

بعض الوثائق الأصلية تالفة
وبالرسالة صفحات لم ترد بالأصل

PATHOLOGICAL STUDY OF DIFFERENT BRAIN AREAS IN FATAL HEAD INJURY

Thesis

Submitted for partial fulfillment of the requirements
of the M.D. degree in Forensic Medicine

by

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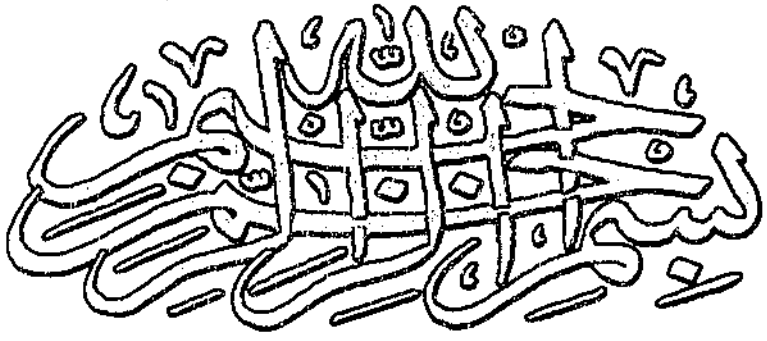

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم
(البقرة: ٣٢)

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Introduction

Introduction

The head is the target of choice in assaults with blunt objects. Although the brain is protected against everyday mechanical stress by being encased in the bony skull, its is not immune to injury ***(Spitz, 1993)***.

An injury can be defined as damage to any parts of the body by application of violence. Of all regional injuries, those of the head and neck are the most common and most important in forensic practice ***(Knight, 1996)***.

Head injury can be defined as any alteration in mental or physical functioning produced by mechanical forces. It remains an important problem in modern society. Deaths from head injury comprise 1-2% of all deaths from all causes, and between one-third to one-half of all deaths due to trauma are due to head injury ***(Gennarelli et al., 1989 and Tamuleviciute, 2002)***.

The nature and distribution of traumatic brain injury are diverse and there are many influences on the outcome from head injury ***(Goldsmith and Plunkett, 2004)***.

The anatomy of the skull and brain and its covering meningeal sheaths is more complex than that of other organs. Therefore, lesions encountered in head injuries showed greater variation in mechanism and distribution than elsewhere in the body ***(Azmak et al., 2002)***.

The neuropathology of brain damage is a large and complex subject, the more subtle varieties requiring both specialist techniques for demonstration and expert knowledge for interpretation. The mechanisms of production of some traumatic lesions are matters of conflicting theories, but the forensic pathologist still have to be aware of the general principles of causation to offer some interpretation of the injuries ***(Knight, 1996)***.


Review of Literature

Anatomy

The Brain Coverings and Protecting Structures:

The Scalp:

It is the soft tissue envelope of the cranial vault. The scalp extends from the external occipital protuberance and superior nuchal lines to the supra orbital margins. It consists of five layers; the skin, connective tissue, epicranial apponeurosis, loose areolar tissue, and pericranium. The first three layers are bound together as a single unit. This single unit can move along the loose areolar tissue over the pericranium which is adherent to the calvarium (Fig. 1) ***(Tedeschi et al., 1977 and Ernest et al., 1999)***.

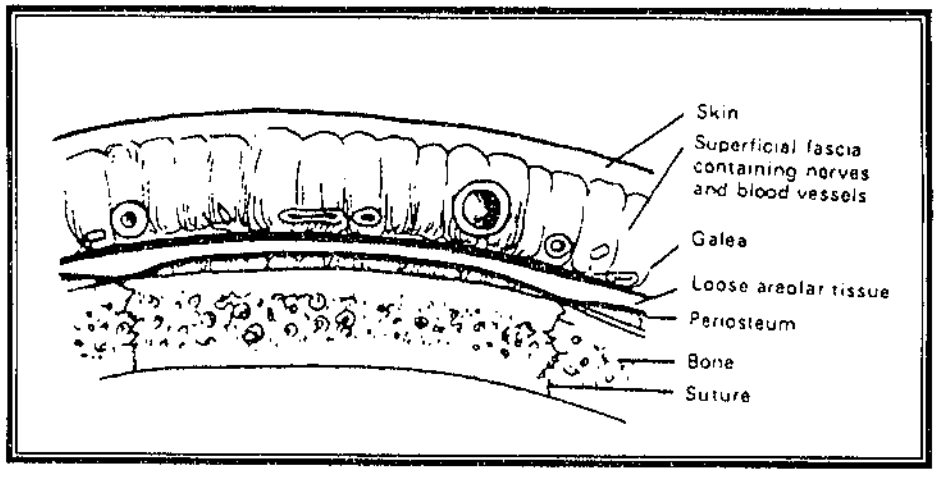

Fig. (1): **Cross-section of the scalp** ***(Gordon et al., 1988)***.

Some veins traverse all the layers from the connective tissue to the pericranium and go on to penetrate the skull and communicate with the intracranial venous sinuses forming a route for meningitis and sinus thrombosis from infected injuries of the scalp ***(Knight, 1996)***.

The Skull:

The adult skull is described anatomically as two regions, namely the base and the vault. The base is rather irregular while the vault is nearly rounded with smooth inner surface. The skull is formed of different flat plates separated by suture lines. Suture lines close by interdigitation during childhood and osseous fusion occurs irregularly at variable dates during life ***(Derek, 1994 and Di Maio, 2001)***.

Generally the thickness of adult skull ranges between 3 and 6mm. It is thin in the squamous portion of the temporal bone and much thicker in the mid-frontal, mid-occipital, parieto-sphenoidal and parieto-petrous buttresses. In early infancy, the bones of the skull are thin and pliable, with no clear differentiation between the inner and outer tables. In the adult, the vault is composed of inner and outer tables of compact bone with the diploe in between; the outer one being about twice the thickness of the inner and they are separated by a central zone of soft cancellous bone. This zone is interrupted at suture lines and vanishes where the bone becomes particularly thin especially in the floor of the skull. This architecture gives added strength with less weight of bone ***(Tedeschi et al., 1977 and Knight, 1996)***.

The base of the skull is not as smooth as the vault. It is rather irregular and even contains sharp edges such as the crysta gali and the lesser wing of the sphenoid. The projecting clinoid processes, petrous temporal bones, and the foramen magnum add to the irregularity of the middle and posteior cranial fossae. These irregularities play an important role in the causation of brain contusion and laceration ***(Eric, 1992)***.

The Meninges:

These are three fibrous membranes (the dura mater, the arachnoid mater, and the pia mater) which enclose the entire central nervous

system, and are separated from each other by two spaces (subdural and subarachnoid spaces) containing fluid ***(Romanes, 1979)***.

(1) ***The Dura Mater:***

The dura mater is formed of two layers of tough collagenous tissue, the outer of which is firmly attached to the skull and acts as its internal periosteum. The inner layer merges with the arachnoid so that in reality there is no true subdural space, only a potential cleavage plane ***(Knight, 1996)***.

The outer layer of dura which applied to the skull extending out into the various exit foramina of the brain which transmit nerves and blood vessels, where it ensheaths these structures. The inner layer of the dura is closely united with the outer layer except at certain lines, where it is pulled up away into various folds to form septa dividing the cranial cavity into a number of compartments ***(Crompton, 1985)***.

The dura forms the falx and the tentorium and the cranial venous sinuses run within it. The falx and tentorium divide the cranial cavity into three major compartments; these contain the two cerebral hemispheres, the cerebellum, and the brain stem. The dura is penetrated by bridging veins especially along the vertex and at the tips of the temporal lobes, also to a lesser extent at the frontal and occipital poles as well as by random vessels elsewhere ***(Spitz, 1993 and Williams et al., 1995)***.

(2) ***The Arachnoid Mater:***

The arachnoid mater is a very thin delicate membrane which does not enter the sulci of the brain. It is closely related to the dura and is separated from it by a potential space called the subdural space. Between

the arachnoid and the pia, lies the subarachnoid space that contains the cerebrospinal fluid which communicates with the cerebral ventricles. The width of the subarachnoid space varies from a few millimeters in the young to a centimeter or more in the old in whom cerebral atrophy has developed *(Sloane, 1994)*.

(3) ***The Pia Mater:***

The pia is not a true membrane but a surface feltwork of glial fibres that are firmly adherent and inseparable from the underlying brain surface and dips into all its sulci. It contains rich plexus of minute blood vessels *(Cecelia et al., 1997)*.

The cerebral pia mater covers the whole surface of the brain including the complex infoldings of the cerebral gyri and cerebellar folia, and becomes invaginated to form the tela choroidea of the cerebral ventricles (Fig. 2) *(Mazza et al., 1982)*.

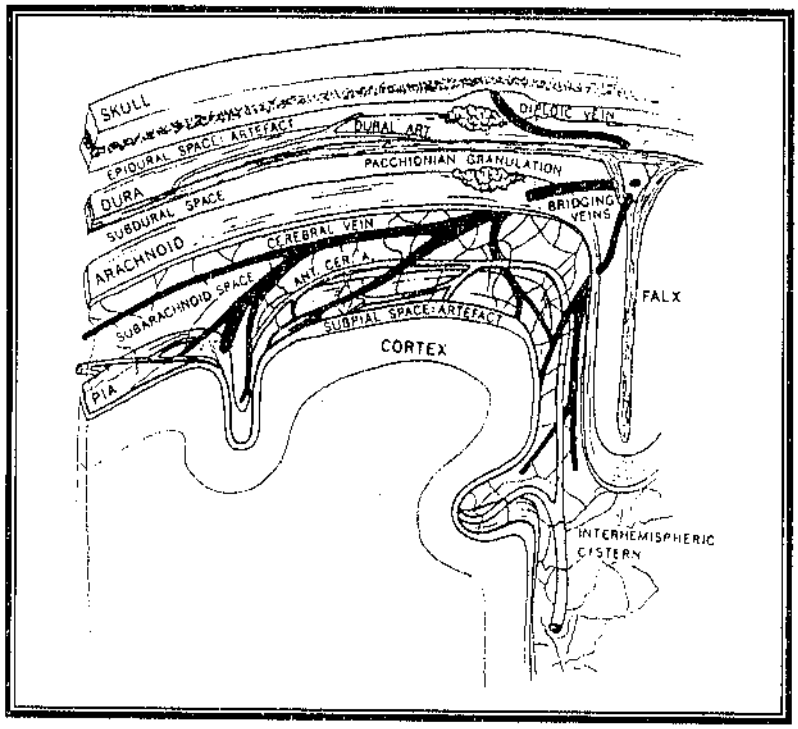

Fig. (2): **Diagram showing the topography of skull, meninges and extracerebral blood vessels** *(Spitz, 1993)*.

The Brain:

The brain is the portion of the central nervous system enclosed within the skull. The brain is a gelatinous like material that floats within a protective sea of cerebrospinal fluid. This fluid supports the brain and acts as a shock absorber in rapid head movements *(Crompton, 1985)*.

The brain consists of three main areas, the cerebrum, the brain stem and the cerebellum *(Williams et al., 1995)*.

(1) *The Cerebrum:*

General feature:

The cerebrum is a large mushroom-shaped portion at the top of the stem, which fill most of the skull. The cerebrum is divided into two hemispheres, the right and the left, which are partially separated from each other by a deep median cleft named the longitudinal cerebral fissure. In the middle of this fissure, the hemispheres are connected together by a thick mass of commissural fibres named the corpus callosum *(Pandya and Yeterian, 1985)*.

The greater transverse diameter of the hemispheres corresponds with a line connecting the two parietal eminences. The surface of the hemisphere presents a number of blunt elevations called gyri separated from each other by a number of grooves called sulci. Each gyrus consists of a central core of white matter covered by a layer of grey matter. The gyri vary in directions and also the sulci vary in depth and directions, so that the arrangement of these is never quite alike in any two brains *(Paxinos, 1990)*.