POST-TRAUMATIC INTRACRANIAL HEMORRHAGE

THESIS

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By

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TO MY PARENTS,

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بسم الله الرحمن الرحيم

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AKNOWLEDGEMENT

God has helped me all the way

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CONTENTS

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HISTORICAL NOTE

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HISTORICAL NOTE

About 100 years ago when the modern era of surgery was begining,John Abernethy (1811) and George Jemas Guthrie (1847) provided excellent descriptions of head injuries and their management of the period.

Guthrie commences his treatise on Injruies of the Head Affecting the Brain with a sentence which sums up in few words the thought of that time. "Injuries of the head affecting the brain are difficult of distinction, treacherous in their course and,for the most part,fatal in their results."

At this time little was understood about the essential pathological processes set in motion by the injury. Intracranial hemorrhage was often thought to be an inflammatory reaction. Subarachnoid hemorrhage was called "hemorrhagic meningitis" and subdural hemorrhage "pachymeningitis hemorrhagica interna". The management of head injuries was largely based upon the treatment accorded to apoplexy on the one hand and inflammation on the other. Bleeding,purgation,cold packs to the head and blisters to the neck appear to have been standard treatment.

Surgical intervention was fraught with the great hazard of infection,and those hemorrhages exposed at operation soon became the side of major inflammatory changes which mostly proved fatal.

Perhaps influenced by Hilton and treatise on Rest and Pain,routine treatment was designed for rest of the injured part. The patient was kept flat,cold packs were placed on the head,while the trunk and limbs were warmed. Morphia was considered a valuable help and was freely given. Venesction was still used if intracranial hemorrhage was suspected. About half the patients admitted to hospital

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and treated in this way died.

About the time of World War I, Harvey Cushing had begun to separate neurosurgery from the rapidly expanding field of general surgery. He introduced rigid disciplines in patient management and operative technique which, when applied to the head injuries of World War I, achieved such resultes that a great deal of attention became focused on neurosurgery.

Nevertheless the period between the two World Wars was not remarkable for its advances in the management of head injuries, but in World War II it received a tremendous impetus from the organization set up by Sir Hugh Cairns and Sir Charles Symonds who saw the advantages of collecting head injuries into a single organization.

In the United States, Stephens Gurdjian and his associates re-investigated the mechanics of skull fracture using new materials and methods, while Shelden and Pudenz, after replacing the calvarium of monkeys with a lucite plate, were able to demonstrate brain movement after impact by high-speed cine-photography.

Correlation between research, investigation of physical mechanisms, pathological sequelae and clinical phenomena continues. Often the complexity of the factors involved still defies solution. Fortunately a very large proportion of the victims of head injury conform to predictable patterns which can be forecast if adequate basic information is available.

(Hooper, 1969.)

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ANATOMICAL CONSIDERATIONS

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After the closing of the fontanelles and sutures of the skull, the interior of the cranium containing the brain is a closed compartment, and, except for the foramen magnum, the only openings into it from the outside are by way of foramina through which blood vessels and nerves pass. Since the brain case can not be stretched and its contents are incompressible, it is evident that blood enters and leaves in equal quantities constantly. Even a slight increase of the blood pressure is reflected by an increase in the intracranial pressure. Delicate adjustments of this pressure must be maintained so that on the one hand the blood pressure is adequate to give a constant supply of oxygen to the nervous tissue, and on the other it is not too great to interfere with function.

The brain is protected by three membranes or meninges and cushioned by a layer of cerebrospinal fluid, which varies in thickness so as to fill in all the depressions in the brain's uneven surface. (Ranson,1959.)

SKULL

In infant, the bones of skull are more resilient than in the adult, and they are separated by fibrous sutural ligaments. In the adult, the inner table of the skull is particularly brittle. Moreover, the sutural ligaments begin to ossify during middle age.

The adult skull may be likened to an eggshell in that it possesses a certain limited resilience beyond which it splinters. A severe, localized blow will produce a local indentation, often accompanied by splintering of the bone. Blows to the vault often result in a series of linear fractures, which radiate out through the thin areas of bone. The petrous parts of the temporal bones and the occipital crests strongly reinforce the base of the skull

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and tend to deflect linear fractures.

In the young child, the skull may be likened to a table - tennis ball in that a localized blow produces a depression without splintering. This common type of circumscribed lesion is referred to as a "pona" fracture.

Fractures of the skull are very common in the adult, but much less so in the young child. The type of fracture that occurs in the skull will depend on the age of the patient, the severity of the blow, and the area of skull receiving the trauma.

Features which tend to prevent fracture of the skull are its elasticity, its rounded shape, and its construction from a number of secondry elastic arches, each made up of a single bone. Moreover, in some places where the bone is thin overlying muscles may offer some resistance in cushioning blows. Examples are the temporal squama and the inferior occipital fossa. (Gray's,1973.)

In fractures of the anterior cranial fossa, the cribriform plate of the ethmoid bone may be damaged. This usually results in tearing of the overlying meninges and underlying mucoperiosteum. The patient will have bleeding from the nose (epistaxis) and leakage of cerebrospinal fluid into the nose (cerebrospinal rhinorrhea). Fractures involving the orbital plate of the frontal bone will result in hemorrhage beneath the conjunctiva and into the orbital cavity, causing exophthalmos. The frontal air sinus may be involved with hemorrhage into the nose.

the most common place for fracture of the base to occur is through the middle fossa, since this is the weakest part of the base of the skull. Anatomically, this weakness is due to the presence of numerous foramina

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and canals in this region; the cavities of the middle ear and the sphenoidal air sinuses are particularly vulnerable. the fissure here usually takes a fairly definite course. Starting from the point struk, usually near the parietal tuber, it runs downwards through the parietal and the squamous temporal and across the petrous portion, frequently traversing and implicating the internal acoustic meatus, to the foramen lacerum. This course explains the symptoms which may arise:thus, if the fissure passes across the internal acoustic meatus, injury to the facial and vestibulo-cochlear nerves may result, with cosequent facial paralysis and deafness; if the fissure extends through the semicircular ducts vertigo will ensue,or the tubular prolongation of the arachnoid around the nerves in the meatus may be torn and thus permit the escape of the cerebrospinal fluid, should there be a communication between the internal ear and the tympanic cavity together with rupture of the tympanic membrane, as is frequently the case.

The third, fourth, and sixth cranial nerves may be damage if the lateral wall of the cavernous sinus is torn. Blood and cerebraospinal fluid may leak into the sphenoidal air sinuses and then into the nose.

In fractures of the posterior cranial fossa, blood may escape into the nape of the neck deep to the post-vertebral muscles.Some days later, it tracks between the muscles and appears in the posterior triangle, close to the mastoid process.The mucous membrane of the roof of the nasopharynx may be torn, and blood may escape there. In fractures involving the jugular foramen, the ninth, tenth, and eleventh cranial nerves may be damaged. The strong bony walls of the hypoglossal canal usually protect the hypoglossal nerve from injury.

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THE MENINGES

The interior of the cranium is lined with dura mater, the surface of the brain is covered with pia mater. Between the two, in contact with the dura mater, lies a membrane known as arachnoid mater.

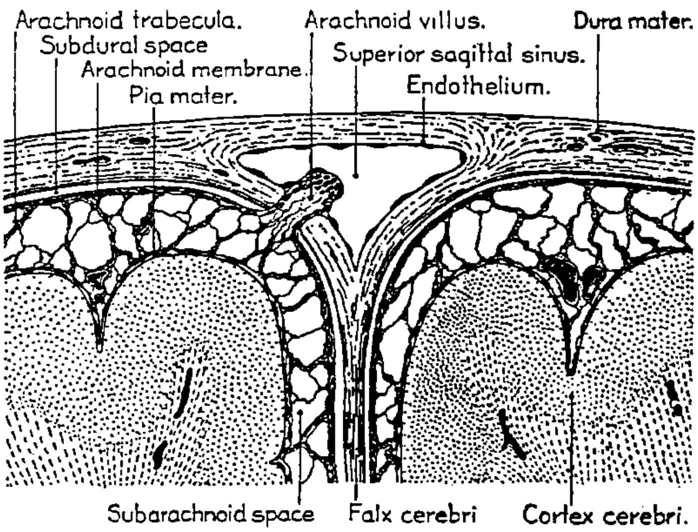

Fig.1 Diagramtic representation of a coronal section through the superior sagittal sinus to illustrate the meninges. (Ranson,1959.)

The Dura Mater

The dura mater is conventionally discribed as consisting of two layers, but it must be emphasized that this is really a false concept. The outer layer is none other than the ordinary periosteum which invests the surface of any bone, since it lies within the skull it

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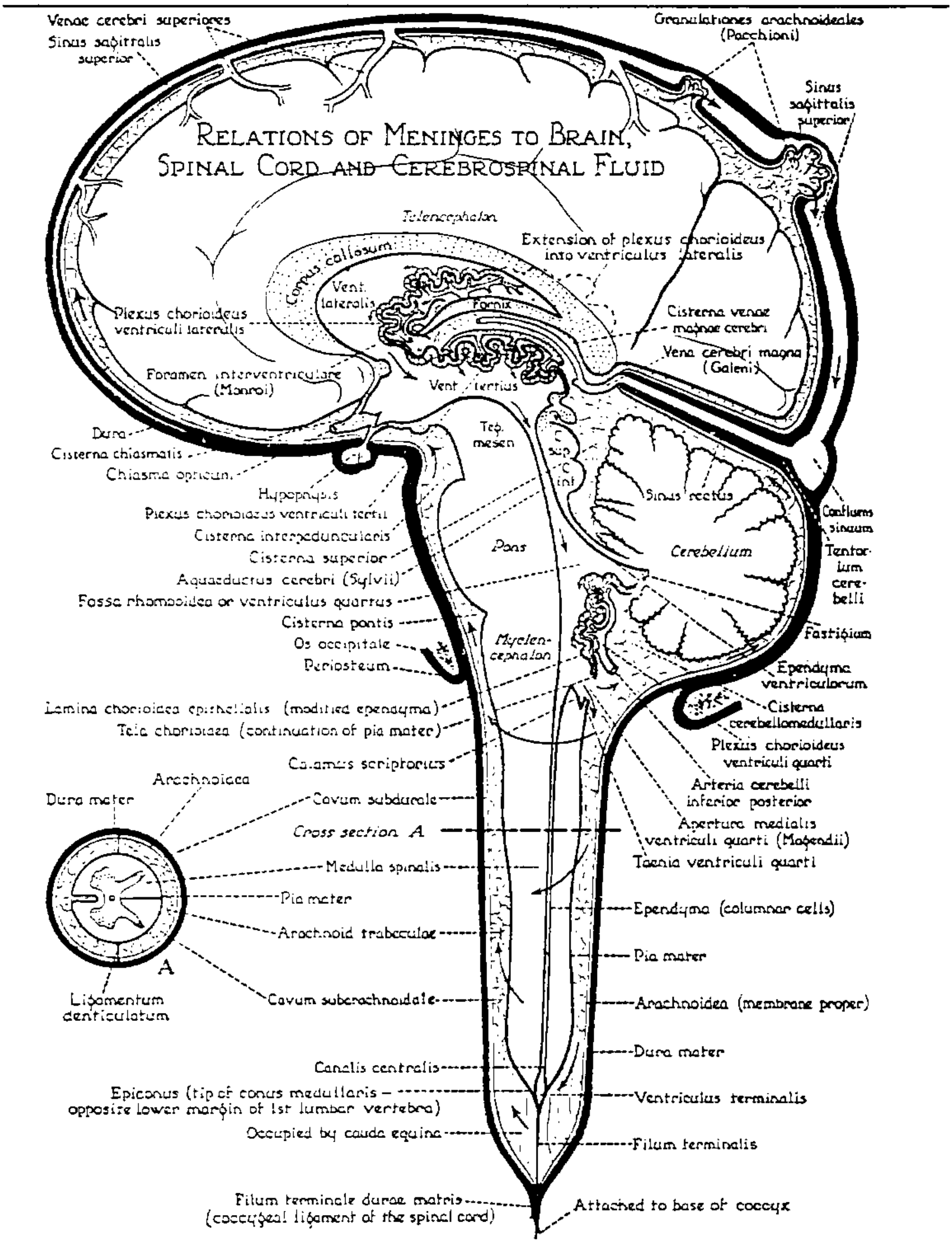

Fig. 2 Diagram of the meninges, brain ventricles, and sub-arachnoid space. The arrows indicate the direction of the flow of the cerebro-spinal fluid.(From Rasmussen,The Princ-ipal Nervous Pathways. By permission of The Macmillan Co., Publishers.) (Ranson,1959.)

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