

Original Article

Meninges: The Mother of the Brain-Etymological and Philosophical aspects

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Abstract:

The meninges are protective coverings around the whole central nervous system comprising of three layers, from outside inwards, Dura mater, Arachnoid mater and Pia mater. These three terms are derived from Latin, where 'mater' means mother. Why this motherhood has been implicated while naming these layers, carries a very interesting history and a strong philosophical background. Dura mater (Tough mother), Arachnoid mater (Spider-like mother) and Pia mater (Tender mother)-all of them cover the central nervous system and possess functional significance not less than that of a protective mother. Ancient Arabic scientists observed those facts and named them accordingly in Arabic. Later they were translated into Latin and are in practice till now. While studying various facts regarding the central nervous system, the etymology and philosophy of 'maternalization of the meninges' draws immense attention.

Keywords : Dura mater, Arachnoid mater, Pia mater, Etymology

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Introduction:

The Meninges (Sing. Mennix) are important to the clinician as a barrier to the internal environment of the brain, and surgically, its anatomy should be well known to the neurosurgeon and clinician who interpret imaging¹.

The Brain and Spinal cord are enclosed in three protective membranes called Meninges. From outside inwards these are a) Dura mater; b) Arachnoid mater and c) Pia mater.

The Dura mater is mesodermal in origin while pia and arachnoid mater are ectodermal (neural crest) in origin¹.

Etymology

The Etymology of Meninges possesses a very interesting history.

The term meninges, singular meninx, a Greek term meaning “membrane,” was first used by Erasistratus in the third century B.C., to describe a membranous covering of the central nervous system. In the second century A.D., Galen described two layers, which he called the *pacheia* and the *lepte*. These were later observed and translated into Arabic by an anonymous muslim physician as umm al-dimagh (mother of the brain), which was later subdivided by Hali Abbas into umm al-ghalida (hard mother) and umm al-raqiqah (thin mother)¹.

These Arabic terms were then literally translated into Latin by the twelfth century Italian monk Stephen of Antioch, as the dura (hard) mater and the pia (tender) mater. The first introduction of the word arachnoid (spider-like) mater was by Herophilus in the third century B.C., who also described its relation to the ventricles. It was later described by the Dutch anatomist Frederik Ruyschin in the seventeenth century. The term mater is derived from ma (from matru meaning mother) and the suffix -ter indicating a state of being^{3,4}.

Philosophical Aspects of Nomenclature

The maternal status has rightly been accorded to a uterus for bearing and bestowing a baby. Arabic researchers observed the embryological and functional aspects of Meninges to be nothing less than the role of a mother.

The neural tube forms the central nervous axis in the developing embryo. Investigations by Kölliker and His and others described the origin of the meninges from

mesenchymal tissue surrounding the neural tube, which was termed the “meninx primitiva” by Salvi in 1898, and denied any contribution of the neural tube^{5,6,7}. The meninx primitiva can be subdivided into two layers, the endomeninx (or secondary meninx), which contribute to the formation of the leptomeninx, and the ectomeninx, which contributes to the formation of the dura. Harvey and Burr stated that the leptomeninges (pia and arachnoid) are derived from ectodermal origins, exclusively those of the neural crest and origin of the dura from the mesoderm^{8,9}.

While the central nervous axis may be assigned the pride of the place, the task of housing, protecting, propping, buoying and vascularizing; insulation of the whole central nervous axis and its ramifications is done by the neural crest cells, with the panache and perfection of a mother³.

Regarding anatomical and functional aspects, the dura mater is the thick outermost covering of the brain and spinal cord that has a protective nature just like that of a mother.

Dura mater, literally the hard mother is co extensive with the cranio-spinal axis for she houses the latter by splitting to form various coeloms each of which spawns and lodges within it the cranial/spinal bones, a sequence that explains why the same dura forms periosteum on the outer side and endosteum on the inner. The dura fashions various chambers and partitions to nestle the central nervous axis, whose precise projections into the cranium creates the falx cerebri ‘et cerebelli’ and a floor for the occipital lobes called tentorium cerebelli. Moreover, the nest mater (dura) fashions numerous coelomic spaces to accommodate the low pressure venous sinuses to render them patent under pressure³.

While the bones of the skull provide most of the safe guarding for the brain, alone it isn't quite enough to fully protect it. Rather the dura mater covers the brain and anchors it to skull bones just like securing the baby on a mother's lap.

Brain itself is a pain insensitive structure. Hereby, dura mater upholds its another functional significance. Dura mater is the most pain sensitive structure and any slight stretching of the dura results in clinical consequence (headache) that alerts the individual to seek care before the pathology causes damage to the brain. This biophysical property of the dura portrays a mother who is always the first person to notice even

a minor harm to her baby and tries utmost to seek help for the well being of her baby.

The Arachnoid mater is named after the Greek word *Arachne* (spider) because of the spider web like appearance of the delicate fibres of the arachnoid (arachnoid trabeculae) which extend down through the subarachnoid space and attach to the pia mater (10).

The arachnoid mater plays its role in buoying up the whole CNS through its contained fluid, cerebrospinal fluid that having the same specific gravity as that of neural tissue, renders the CNS essentially weightless; much as the amniotic fluid does to the fetus. A vital outcome of the buoyancy accorded to the brain is to steer away the wider part of the medulla from pressing the vertebral vessels against the foramen magnum, a fact tragically verifiable uncommonly by instant death from medullary coning on sudden release of high pressure CSF to the exterior (3)

The subarachnoid space provides a fluid sleeve to all nerves going in and out of the cranio-spinal axis. The CSF in the sub arachnoid space and that within the CNS communicates freely providing an effective adjustment of pressure within and around the CNS. The arachnoidal septae traverse freely the inter-communicating cavernous spaces providing fluid support to the vessels travelling to and fro. The maternal role of this layer is a fascinating illustration of the functional necessities being the mother of structural innovations (3).

In Latin '*Pius*' means kind or tender. Pia is the feminine of Pius which is used in this gender to agree with mater (mother). So, Pia mater means the tender protector of the brain and the spinal cord.

The pia mater is a tunic that closely clings to the entire delicate CNS, faithfully following it through every crevice with the tenderness of a loving mother.

Moreover, it is designed to allow the vasculature to branch and plexicate itself in the pia mater so as to occupy the least space in the substance of the CNS and to equitably vascularize over it (3).

Conclusion:

It is explicit that the 3 maters cover the gray and white matters, leading one to muse over their very etymology: Mater, matter, matti, mud, matrix, metrium are all rooted in the universal ma, matru meaning mother. For convenience, mater has implied motherhood and matter has connoted materiality. In a manner of speaking, we all carry 5 mothers within our skulls, 3 maternal (dura, arachnoid and pia mater) and 2 material (gray and white matter), all having been derived epigenetically from the neuroectoderm (3)

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