THE ANATOMY AND HISTOLOGY OF THE MEDULLA OBLONGATA OF THE ADULT ALBINO RAT

THESIS

Submitted for the Partial Fulfilment of

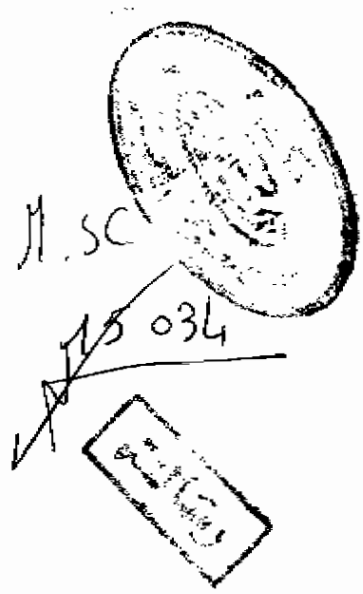
The Master Degree of Medical Sciences

(M.Sc. Anatomy)

BY

USAMA AHMED HUSSEIN

M. B., B. Ch.



Supervised By

Prof. Dr. YEHIA YOUSSEF Ph. D.

Prof. Dr. IVONE KAMEL. M.D.

Prof. Dr. REDA KHORSHID M.D.

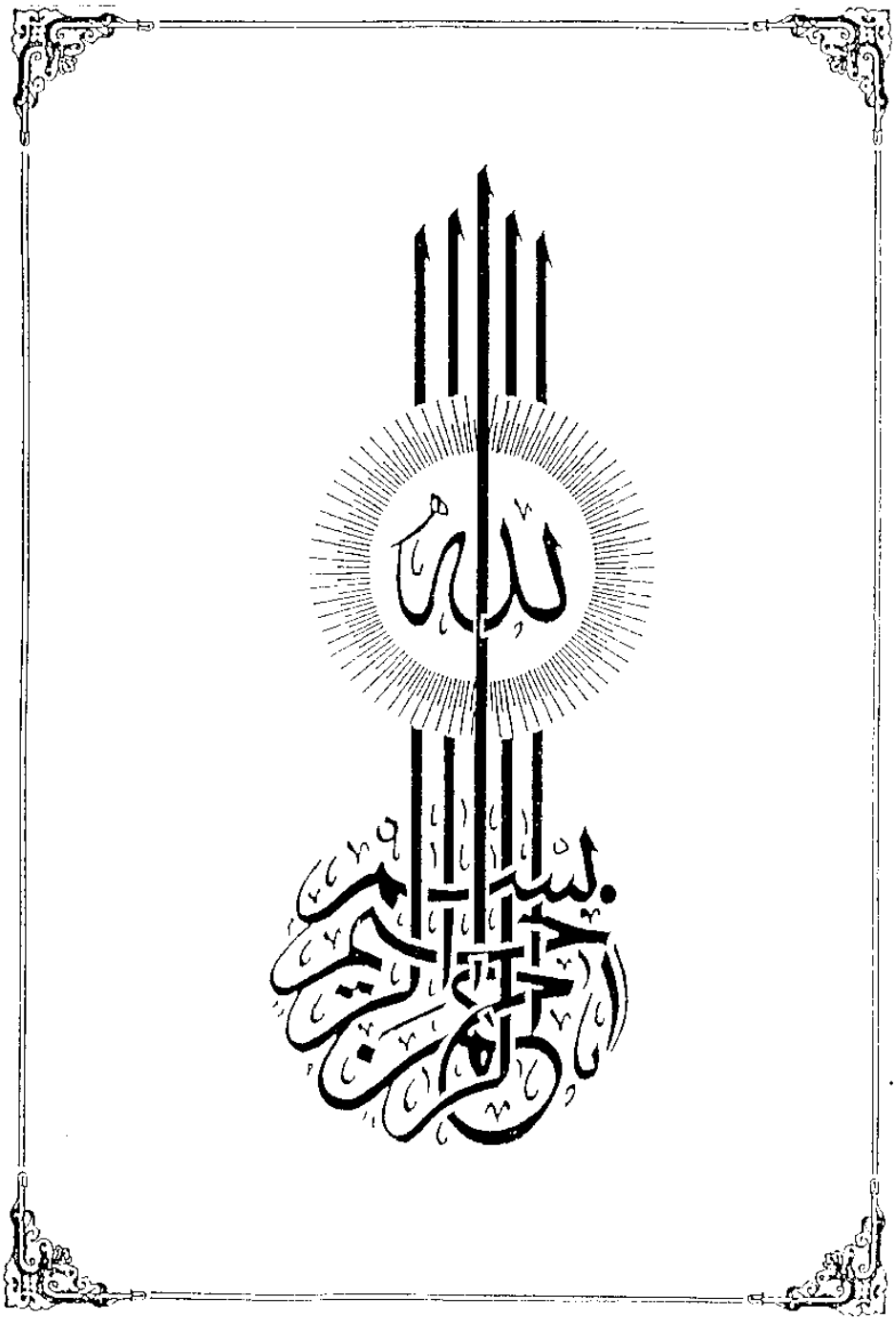
Faculty of Medicine

Ain Shams University

1982

A C K N O W L E D G E M E N T

This work was suggested and planned by Professor Yehia Youssef, Professor Ivone Kamel and Professor Reda Khorshid to whom I am deeply grateful for their constant supervision, continuous encourgement and criticism throughout the whole work.



C O N T E N T S

REVIEW OF LITERATURE

REVIEW OF LITERATURE

A. Macroscopic Anatomy

Malcolm (1964), described the medulla oblongata of dogs. He mentioned that, the pyramids were found on the ventral aspect separated by the ventral median fissure. The inferior olive pulged from the caudoventral part directly dorsolateral to the pyramids. Just caudal to the pons, a group of transverse fibers, the trapezoid body, was found. Among the fibers of this band, the abducent nerve was emerging with the facial nerve lateral to it. The fibers of the vestibulocochlear nerve was superficially attached to the ventro-lateral border of the medulla oblongata directly caudal to the superficial origin of the trigeminal nerve. He also added that the ninth, tenth and eleventh cranial nerves were emerging in a linear fashion just caudal to the superficial origin of the vestibulocochlear nerve along the lateral border of the medulla oblongata. On the dorsal aspect, the rostral part of the medulla oblongata formed the floor of the caudal portion of the fourth ventricle. The roof of this part of the fourth ventricle was formed by the posterior medullary velum.

Sisson and Grossman (1965), studied the medulla oblongata of horses. They stated that, the ventral surface

of the medulla oblongata was divided in the midline by a ventral median fissure which was covered rostrally by the transverse fibers of the pons and partially filled by the decussation of the pyramids caudally. They also mentioned that the pyramids were found between the ventral median fissure and the ventral lateral sulcus, through the latter the fibers of the abducent and hypoglossal nerves were leaving the medulla. The fibers of the glosso-pharyngeal, vagus and accessory nerves were emerging from the lateral ventral sulcus. Moreover, they described the dorsal surface of the medulla oblongata which contained the rhomboid fossa in its upper half forming the floor of the fourth ventricle with the caudal cerebellar peduncle on either sides. The lower part of the dorsal surface of the medulla oblongata was formed of the tubercles of gracile, cuneate and spinal nucleus of the trigeminal nerve arranged in a mediolateral order.

Rowett (1968), investigated the macroscopic structure of the medulla oblongata of the albino rat, he described the medulla as a conical mass, with its tapering end directed caudally and continuous with the spinal cord, and its upper broad end continuous with the pons but they

were separated by a band of transverse fibers. He also stated that the anterior surface of the medulla represented a median sulcus, lateral to this sulcus the cranial nerves from the ninth to the twelfth were emerging.

Wells (1968), in his study on the medulla oblongata of the adult albino rat, he described the pyramids as two flattened masses on either side of the median anterior sulcus. On the caudal part of the dorsal surface he described two tubercles namely the gracile and cuneate tubercles. He also stated that the cerebellum appeared to cover almost completely the upper half of the dorsal surface of the medulla oblongata. On removing the cerebellum, the cavity of the fourth ventricle was opened and the rhomboid fossa which represented the floor of the caudal half of the fourth ventricle appeared.

Warwick and Williams (1973), described the external features of human medulla oblongata. They mentioned that a deep anterior median fissure was found anteriorly which ended above in a small triangular area termed the foramen caecum but below it was interrupted by the pyramidal decussation. On both sides of the anterior median fissure, the pyramids were found which were followed more

laterally by the anterolateral sulcus from which the hypoglossal nerve rootlets amerged between the pyramids medially and the olive laterally. The olive was bounded posteriorly by the posterolateral sulcus from which emerged the fibers of the glossophyryngeal, vagus and accessory nerves. The posterior part of the medulla was bounded between the posterolateral sulci of both sides, it contained in its caudal part a narrow sulcus which was found in the middle line called the posterior median sulcus. Lateral to this sulcus the gracile tubercle, cuneate tubercle and the tuberculum cinereum were arranged in a mediolateral order. The upper part of the posterior surface was formed by the inferior cerebellar peduncles.

Sisson and Grossman (1975),in their investigation on the medulla oblongata of the dog, they described the exit of the hypoglossal nerve from the ventral lateral sulcus at the lateral edge of the pyramids in the form of rootlets.They also gave an account on the external arcuate fibers and stated that they sweeped dorsorostrally from the olivary prominence to the caudal cerebellar peduncle.

Sisson and Grossman (1975), studied the medulla oblongata of pigs and stated that, it was relatively

wider than the medulla of other domestic animals. The trapezoid body was broad and thin and protruded very little from the ventral surface. The pyramids were visible on the ventral surface on either side of the midline but did not protrude on the surface with the olives on their lateral sides. They also observed that, the dorsal surface of the medulla was almost completely covered by the broad cerebellum. The tubercle of the gracile nucleus was very small while the cuneate tubercle was quite large. The rhomboid fossa which formed the floor of the lower part of the fourth ventricle presented prominent areas for the hypoglossal, vagal and vestibular nuclei. The lateral recesses which extended from the fourth ventricle were very well developed and might even extend caudally and ventrally.

Sisson and Grossman (1975), in their study on the medulla oblongata of the ruminants recorded that, the medulla was divided ventrally by a ventral median fissure which was continuous with the median fissure of the spinal cord caudally. Two other sulci were described namely the ventral lateral sulcus and the dorsal lateral sulcus, from the first emerged the rootlets of the hypoglossal nerve and from the second emerged the fibers of the glosso-pharyngeal and vagus nerves. The pyramids were found between

the ventral median fissure and ventral lateral sulci. They were smaller in the cattle. As the pyramids emerged from the pons they were about 1cm from the median plane but caudally they converged to lie adjacent to each other near the decussation. A transverse band, the trapezoid body, was observed caudal to the pons which was more marked in small ruminants than cattle, the abducent nerve emerged through its medial part, the vestibulocochlear nerve through its lateral end with the facial nerve in between.

Rudolf and Stromberg (1976), described the external appearance of the medulla oblongata of the adult albino rat. They stated that, it began about 3mm rostral to the origin of the first cervical nerve (at the level of the foramen occipitale magnum) and extended to the pons. On its rounded ventral surface a shallow midline groove was found which was continuous below with the median fissure of the spinal cord and continuous above with a shallow groove on the ventral surface of the pons which carried the basilar artery to the circulus arteriosus. Furthermore, they described a pair of flattened masses on either side of the median fissure which represented the pyramids. Decussation of pyramids occured at the caudal end. Rostrally, the medulla oblongata was bounded

by the transversely running band of corpus trapezoideum.

On the other hand, the dorsal surface of the medulla oblongata formed most of the floor of the fourth ventricle (rhomboid fossa), in its caudolateral region the eminentia vestibularis medialis was found, laterally the medulla oblongata joined the cerebellum by means of the inferior cerebellar peduncles with the semilunar tuberculum acusticum caudolateral to them. Caudally, the lateral walls of the fourth ventricle merged at right angles supporting the area postrema. Further caudally, the shallow sulcus medianus dorsalis continued to the spinal cord with the gracile and cuneate tracts on both sides of the sulcus. The glossopharyngeal nerve emerged from the sulcus lateralis ventralis with the vagus and accessory nerves caudal to it, while the hypoglossal nerve emerged from the ventral aspect of the medulla oblongata lateral to the pyramids.

Last (1979), in his description to the human medulla oblongata, he mentioned two types of arcuate fibers, the first was the external arcuate fibers arising from the aberrant pontine fibers and might be seen as transverse ridges crossing in front of the olive in their way to enter the cerebellum via the inferior cerebellar

peduncle. The second type which was called the internal arcuate fibers arised from the gracile and cuneate nuclei and entered the cerebellum via the inferior cerebellar peduncle.

B. Microscopic Anatomy

Carpenter (1976), stated that, the most conspicuous features of sections through the closed human medulla were the decussation of the corticospinal tracts, the first appearance of the nuclei of the posterior column and the appearance of the medullary reticular formation. The central gray increased in size and lied mostly dorsal to the central canal.

Corticospinal tracts decussation :-

Warwick and Williams (1973), and Carpenter (1976), noticed that, the human medulla oblongata showed bundles of pyramidal fibers which crossed the midline ventral to the central gray and projected dorsolaterally across the base of the anterior horn. These fibers crossed in interdigitating fashion having a downward as well aw transverse direction ; in transverse sections these bundles were cut obliquely, so that in the same section more pyramidal fibers might be present on one side.

Dorsal column nuclei :

Taber (1961), in his investigations divided the cat gracile nucleus into 3 regions : (1) Reticular region; rostral to

the obex and characterized by loose organization of cells; (2) Cell nest region caudal to the obex and formed of cell clusters; (3) Caudal region formed of scattered cells occuring singly or in small clusters.

Kuypers and Tuerk (1964), worked in the cuneate nucleus of the cat and they described it in 2 areas :- (1) Dorsal area which contained clusters of round cells with bushy dendrites; (2) Basal area formed of triangular multipolar and fusiform cells with long sparse dendrites.

Hand (1966), divided the gracile nucleus of the cat on the basis of cell size and arrangement as seen in transvers and longitudinal sections of the medulla oblongata into: (1) The reticular region, a rostral part which extended from the rostral pole of the nucleus to the obex region and consisted primarily of small, diffusely arranged neurons; (2) The cell nest region, a middle part which extended from approximately 2mm below the abox region caudally for 3-4mm. It consisted primarily of large neurons arranged in cell clusters; (3) The caudal region which extended from the cell nest region caudally to the rostral pole of the second cervical segment and consisted primarily of large neurons which were few in number and occured singly or in very small isolated cell clusters.