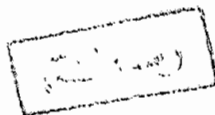


Ocular Manifestations Of Brain Stem Lesions

Thesis submitted for partial
Fulfillment of
M.S. degree in Ophthalmology



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Abbreviations

MLB	Medial longitudinal bundle
PPRF	Paramedian pontine reticular formation
riMLB	Rostral interstitial nucleus of medial longitudinal bundle
VOR	Vestibulo ocular reflex
UMNL	Upper motor neuron lesion
LMNL	Lower motor neuron lesion

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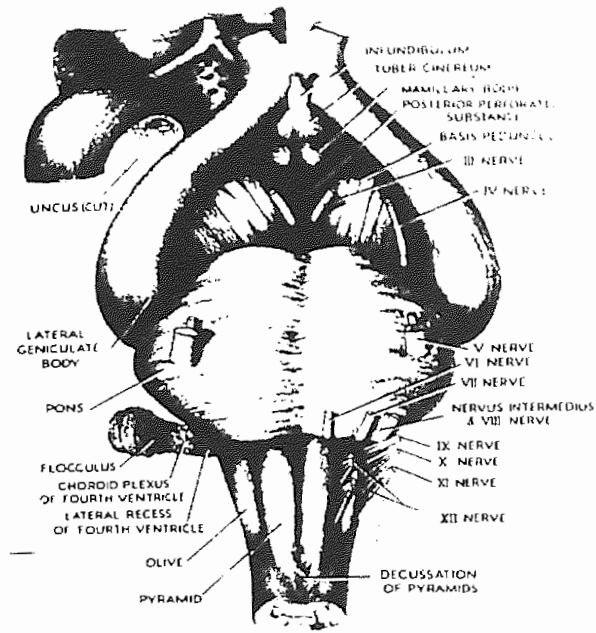
Introduction

Examination of the eye is one of the important tools which can be used to diagnose different neurological lesions. Brain stem lesions will affect the eye in the form of changes in the optic nerve head (papilledema), disturbances in the extra ocular muscles movements and changes in the pupillary reflexes.

Fundus examination is important in brain stem lesions as these lesions may obstruct the aqueduct of Sylvius leading to increase in the intracranial pressure leading to papilledema.

Extra ocular muscles will be affected in brain stem lesions as the nuclei of third, fourth and sixth cranial nerves that supply the extraocular muscles are located in brain stem. Also the nuclei controlling horizontal and vertical gazes are located in the brain stem. The pupil is controlled by parasympathetic fibers originating from Edinger Westphal nucleus in the brain stem and by ocular sympathetic fibers which pass through the brain stem to terminate on the dilator pupillae muscle.

The brain stem consists of mid brain, pons and medulla. However, the structure of the medulla will not be included in our discussion because it has no relation to the eye except that the ocular sympathetic fibres traverse the medulla on their way to the spinal cord.



VENTRAL ASPECT OF THE BRAIN STEM. The optic tract embraces the crus (basis pedunculi). Lateral to the optic chiasma the medial and lateral roots of the olfactory tract enclose the anterior perforated substance. Drawn from a specimen.

Fig. (1) (Last 1986)

(A) ANATOMY OF THE MIDBRAIN

The midbrain passes in the gap of tentorium cerebelli to connect the pons and cerebellum with thalamus and subthalamus. (Fig. 1) . The cavity of midbrain is the aqueduct . It is divided into 2 parts (Fig. 2, 3):

dorsal part (Tectum) which is composed of four colliculi two superior colliculi and two inferior colliculi and **ventral part (cerebral peduncles)** which is divided into :

- (a) basis pedunculi : containing nerve fibres arising from cerebral cortex.
- (b) substantia nigra : it is a pigmented lamina of grey substance forming a part of extra pyramidal system .
- (c) tegmentum : It is the reticular formation containing nuclei and tracts.

Structure of Some Important Areas

(A) Superior Colliculus

It is concerned with visual reflexes.

Connections

1- Afferents

- * from the retina via superior brachium.
- * from the occipital cortex and optic radiation via superior brachium.
- * from the spinal cord via spino tectal tracts.
- * from the opposite superior colliculus.
- * from the same side inferior colliculus.

2- Efferents

- * to the opposite side tectospinal and tectobulbar tracts to control the movements of the body and head in relation to visually evoked reflexes.
- * to the nuclei of oculomotor, trochlear, abducent and accessory nerves.
- * to the medial longitudinal bundle.

(B) Inferior colliculus

It is concerned with auditory reflexes.

Connections

1- Afferents

- * from the lateral lamniscus (part of auditory pathway) and temporal (auditory) cortex.

2- Efferents

- * to the opposite inferior colliculus.
- * to the same side superior colliculus.
- * to the medial geniculate bodies.
- * to the tectospinal and tecto bulbar tracts of the opposite side.

(C) Pre tectal nucleus :

It is found deep to the upper lateral part of the superior colliculus.

Connection

1- Afferents

- * from the optic tract, these fibres are for pupillary light reflex.
- * from the occipital cortex.

2- Efferents

- * to both Edinger-Westphal nuclei.

Important Nerves & tracts

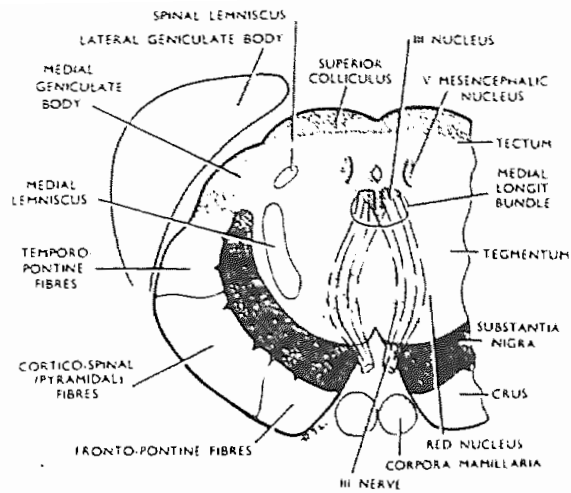
I- Oculomotor nerve (Fig 2)

Nucleus: It lies at the level of superior colliculus in the central part of grey matter Just beside the midline and dorsal to the medial longitudinal bundle.

It supplies all extraocular muscles except superior oblique and lateral rectus.

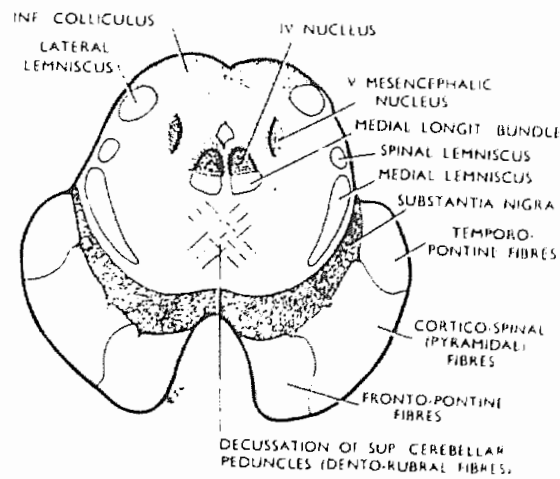
It is composed of five cell masses.

- * (Pair) Dorsal mass supplies inferior rectus
- * (Pair) Ventral mass supplies medial rectus



CROSS SECTION OF THE MIDBRAIN THROUGH THE SUPERIOR COLLICULI.

Fig. (2) (Last 1986)



CROSS SECTION OF THE MIDBRAIN THROUGH THE INFERIOR COLLICULI.

Fig. (3) (Last 1986)

- * (Pair) Intermediate mass supplies inferior oblique
- * (Unpaired) Central caudal nucleus supplies levator muscle
- * (Ventral nucleus) Edinger Westphal nucleus (E . W. N) . It lies dorsal to the upper end of the oculomotor nucleus, gives preganglionic parasympathetic fibres to the ciliary ganglion then to the ciliary muscle and sphincter pupillae muscle.

The superior rectus muscle is supplied by the contralateral oculomotor nucleus. The fibres to the S.R decussate within the 3rd nerve nucleus & Join the fascicle of the contra lateral oculomotor nerve (Kanski 1989).

Connections

1- Afferents

Via the Corticonuclear fibres ----> Same side & other side.

- * from the cerebral cortex via pyramidal tract.
- * from the superior colliculus.
- * from the cerebellum via superior cerebellar peduncle.
- * from pre tectal nucleus of both sides for light reflex -----> E.W.N.

2- Efferents

- * to trochlear, abducent and to the opposite oculomotor nucleus.

Fibres:

The nerve fibres pass from the nucleus through medial longitudinal bundle and red nucleus & the medial margin of substantia nigra to emerge from the mid brain. 10-15 rootlets at the level of superior colliculus.

II- Trochlear Nerve (Fig 3)

Nucleus: It contains somatic efferent fibres that supply the superior oblique muscle. It is located in the ventral part of central grey matter at the level of the inferior colliculus close to the midline and dorsal to the medial longitudinal bundle.

Fibres

They run dorsally encircling the aqueduct and decussate in superior medullary velum. They merge in the roof of midbrain at the upper end of superior medullary velum lateral to the frenulum i.e. supplying the opposite side muscle.

III- Medial Longitudinal Bundle (M.L.B.)

It is an important association tract that extends from the floor of third ventricle to the spinal cord. It ends on the anterior grey column of the spinal cord.

It is located just beside midline, ventral to the medial motor somatic nuclei (oculomotor, trochlear, abducent and hypoglossal nuclei)

It contains short fibres which ascend or descend. These fibres are derived from:

- * vestibular nuclei of both sides.

- * interstitial nucleus which is situated between hypothalamus and midbrain.

- * superior colliculus.

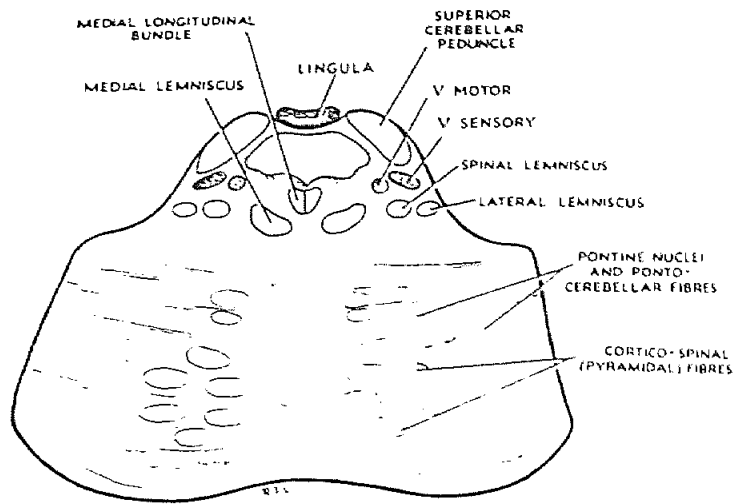
- * lateral lemniscus.

- * intersegmental bundles in the spinal cord.

Functions

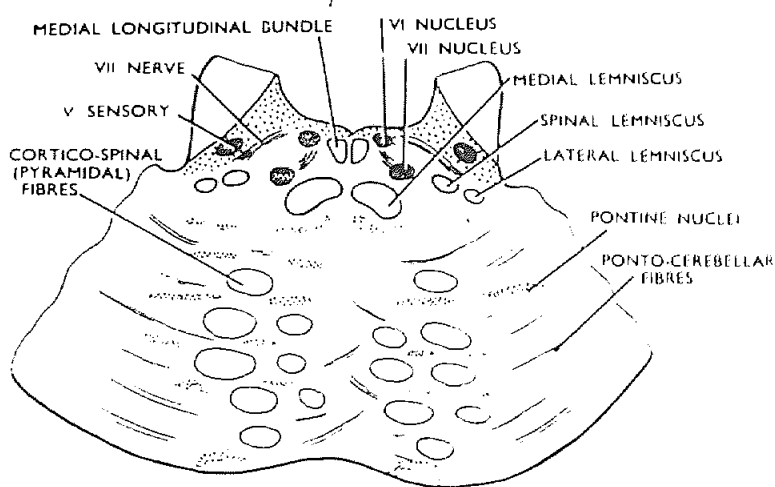
It connects ocular motor nuclei with each other and with other cranial nerves nuclei.

It also connects ocular motor nuclei with vestibular and cochlear nuclei thus through these connections the bundle is concerned with coordination and reflex control of eye, head and neck in response to visual, auditory and vestibular stimuli



CROSS SECTION OF THE UPPER PART OF THE PONS.

Fig. (4) (Last 1986)



CROSS SECTION OF THE LOWER PART OF THE PONS.

Fig. (5) (Last 198)