

Normal pupil

- ▶ Normal pupil is round, regular, centered in the iris and 3-5mm in size. In old age the size is <3mm.
- ▶ In bright light, the pupil constricts to a minimum diameter of 2 mm and in dark, it dilates to about 8mm.
- ▶ Pupils are examined for any difference in their size under normal illumination.
- ▶ Size of the pupil changes due to the action of 2 muscles, the circumferential sphincter pupillae which is innervated by parasympathetic nervous system and radial dilator pupillae which has alpha adrenergic sympathetic receptors which respond to changes in sympathetic tonus and changes in the blood level of circulating catecholamines.

Pathway of ocular sympathetic fibres

HYPOTHALAMUS (1ST ORDER NEURONS)



BRAINSTEM



INTERMEDIOLATERAL HORN OF SPINAL CORD AT C8 AND T1 LEVEL



2ND ORDER NEURON FROM C8 & T1 GO TO SUPERIOR SYMPATHETIC GANGLION



3RD ORDER NEURON FROM THERE IS CARRIED AROUND CAROTID ARTERY TO THE OPHTHALMIC DIVISION OF 5TH CRANIAL NERVE

NASOCILIARY NERVE



LONG CILIARY NERVE



OCULOPUPILLARY FIBRES



SUPPLY DILATOR PUPILLAE AND MULLER'S MUSCLE OF UPPER EYELID

Miosis

- If pupillary size is $<3\text{mm}$, it is called miosis.



Causes of unilateral miosis

1. Irritation of parasympathetic
2. **Horner's syndrome** (due to oculosympathetic paresis)

Central horner's syndrome (1st order neuron). Hypothalamic lesion, tumor, hemorrhage, brainstem stroke, lateral medullary syndrome, syringomyelia

Bronchogenic carcinoma - pancoast's tumor (tumor of pulmonary apex) in advanced stages can compress cervical sympathetic (2nd order neuron).

Metastatic carcinoma of neck - Rowland Payne syndrome (Disrupting the oculosympathetic nerve, vagus nerve and phrenic nerve).

T1 radiculopathy

Post ganglionic - carotid artery disease (aneurysm) at cavernous sinus.

Readers paratrigeminal syndrome (painful Horner's syndrome) - due to compression of 5th cranial nerve by ICA aneurysm.

Parkinson's syndrome - 6th nerve lesion + Horner's syndrome

Causes for bilateral miosis

- ▶ Old age
- ▶ Argyll Robertson pupil (lesions like neurosyphilis in the region of tectum.)
- ▶ Pontine haemorrhage
- ▶ Iritis
- ▶ Organophosphorus or alcohol poisoning
- ▶ Application of pharmacological miotics like pilocarpine.
- ▶ Overdose of neostigmine.

Pin point pupil

PUPILLARY SIZE 1MM OR LESS IS KNOWN AS PIN POINT PUPIL.





Causes for pin point pupil

- PONTINE HAEMORRHAGE
- ORGANOPHOSPHORUS OR ALCOHOL POISONING
- CLONIDINE AND TETRAHYDRAZOLINE
- APPLICATION OF PILOCARPINE DROPS
- MORPHINE OR BARBITURATE POISONING
- HEAT STROKE

Pathway of ocular parasympathetic fibres

AFFERENT: FROM RETINA THROUGH OPTIC NERVE TO THE PRETECTAL NUCLEUS OF MIDBRAIN. PRETECTAL NUCLEUS CONNECTS WITH EDINGER WESTPHAL NUCLEUS OF BOTH SIDES.

EFFERENT: PARASYMPATHETIC FIBRES ARISE FROM THE EDINGER-WESTPHAL NUCLEUS IN THE MIDBRAIN AND TRAVEL ALONG THE 3RD CRANIAL NERVE. THE PREGANGLIONIC FIBRES ENTER THE INFERIOR DIVISION OF THE 3RD NERVE AND VIA THE NERVE TO INFERIOR OBLIQUE REACH THE CILIARY GANGLION TO RELAY. POST GANGLIONIC FIBRES TRAVEL ALONG THE SHORT CILIARY NERVES TO INNERVATE THE SPHINCTER PUPILLAE.

Mydriasis

- If size of the pupil is $>5\text{mm}$, it is known as mydriasis.



Causes of unilateral mydriasis

- ▶ 3rd nerve palsy.
- ▶ Adie's pupil or myotonic pupil.(post ganglionic parasympathetic pupillomotor damage)
- ▶ Optic atrophy
- ▶ Acute congestive glaucoma.
- ▶ Head injury
- ▶ Tentorial herniation (same side)

Causes of bilateral mydriasis

- ▶ Childhood, anxiety or fear
- ▶ Application of mydriatic (atropine)
- ▶ Datura poisoning
- ▶ Deep coma
- ▶ Severe raised intracranial tension.
- ▶ Cerebral anoxia
- ▶ Death

Hippus

It is the alternating dilatation and constriction of pupil.

Causes

- ▶ Autonomic imbalance
- ▶ recovering 3rd nerve lesion
- ▶ Chorea

Anisocoria (unequal pupils)

The eyes should be assessed to determine which is the abnormal pupil.

Causes

commonest cause is the application of mydriatic to one eye.

Unilateral sympathetic paralysis or irritation

unilateral 3rd nerve lesion as in brain stem damage, transtentorial herniation

pressure effect on 3rd nerve in tumor or aneurysm

Blindness in one eye

- ▶ Encephalitis
- ▶ Iritis
- ▶ severe head injury
- ▶ Holmes - Adie pupil
- ▶ Meningioma
- ▶ migraine

