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CLINICAL FEATURES OF VISUAL AND OCULAR MOTOR DISORDERS

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Fall, 2008
Image of a doctor performing a visual field exam was removed.
Image of a doctor performing an eye exam was removed.
Right Complete Homonymous Hemianopia
Ocular Motor System

1. Move the Eyes from One Equidistant Target to Another ("Saccades")
2. Move the Eyes from Distant to Near Target or Vice Versa ("Vergence")
3. Keep the Eyes on Target When the Target Moves ("Pursuit")
4. Keep the Eyes on Target When the Head Moves ("Vestibulo-ocular")
Saccades

1. Voluntary
   a. Move eyes to target seen in peripheral field ("visually guided")
   b. Move eyes to unseen target ("non visually guided")

2. Involuntary
   a. Rapid eye movements of sleep
   b. Fast phases of nystagmus
   c. Random
Saccades

Test by having patient fixate a stationary target and then look from one target to another.

Note whether eyes are still during fixation, and note speed, amplitude, accuracy of refixations, and if oscillations are present.
Control of Horizontal Saccades (1)

- Supplementary eye field
- Frontal eye field
- Dorsolateral prefrontal cortex
- Caudate
- Substantia nigra pars reticulata
- Lateral geniculate body
- Parieto-occipital junction
- Visual cortex
- Superior colliculus
- Cranial nerve III nucleus
- Cranial nerve VI nucleus
- Cerebellar vermis
- Pontine paramedian reticular formation
- Medial vestibular nucleus
- Nucleus prepositus hypoglossi
Control of Horizontal Saccades (2)

- Mesencephalon
- Cranial nerve III (medial rectus) nucleus
- Medial longitudinal fasciculus (MLF)
- From PPRF
- Cranial nerve VI nucleus
- MLF
- Caudal pons
- To lateral rectus muscle
Control of Vertical Saccades (1)

- Supplementary eye field
- Frontal eye field
- Dorsolateral prefrontal cortex
- Caudate
- Substantia nigra pars reticulata
- Interstitial nucleus of Cajal
- Rostral interstitial nucleus of the medial longitudinal fasciculus
- Lateral geniculate body
- Parieto-occipital junction
- Visual cortex
- Superior colliculus
- Cranial nerve III nucleus
- Cranial nerve IV nucleus
Control of Vertical Saccades (2)

Upward gaze
- Posterior commissure
- Rostral interstitial nucleus of the medial longitudinal fasciculus (riMLF)
- Interstitial nucleus of Cajal (INC)
- Cranial nerve III (superior rectus subnucleus)

Downward gaze
- Cranial nerve III (superior oblique subnucleus)
- Cranial nerve III (inferior rectus subnucleus)
- Cranial nerve IV (superior oblique) nucleus
Saccadic Disorders

1. Absent (gaze palsy)
2. Reduced amplitude (“hypometric”)
3. Slow
4. Inaccurate (“dysmetric”)
5. Intrusive
Vergence

1. Move eyes closer to one another ("convergence")

2. Move eyes farther apart from one another ("divergence")
Vergence

Test by measuring ocular alignment when eyes are focusing on a distant and on a near target
Vergence Pathway

1. Generated in both parieto-occipital regions
2. Travels to midbrain
3. Exact pathway not known
Vergence Disorders

• Excessive convergence
• Insufficient convergence
• Excessive divergence
• Insufficient divergence
Vergence Disorders

1. Excessive convergence
   a. Congenital defect
   b. Too much accommodation
   c. Loss of vision
   d. Nonspecific brain insult

2. Insufficient convergence
   a. Idiopathic
   b. Nonspecific brain insult
Vergence Disorders

1. Excessive Divergence
   a. Congenital defect
   b. Loss of vision

2. Insufficient Divergence
   a. Nonspecific brain insult
Pursuit

Test by having patient follow a moving light or finger at about 30 degrees/second

Note smoothness of motion, amplitude of excursion, presence of oscillations
Control of Horizontal Pursuit

Frontal eye field

Lateral geniculate body

Parieto-occipital junction

Temporo-occipital junction

Visual cortex

Cranial nerve III nucleus

Cranial nerve VI nucleus

Cerebellar vermis

Dorsolateral pontine nucleus

Medial vestibular nucleus

Nucleus prepositus hypoglossi
Pursuit Disorders

1. Cogwheel ("saccadic")
2. Absent
Vestibulo-ocular

In awake patients with intact voluntary eye movements, can test only with special techniques.
Vestibulo-ocular

In comatose patients and in awake patients with poor voluntary eye movements, two tests:
1. Doll’s Head Maneuver. Move head rapidly and look for slow contraversive conjugate eye movements
2. Cold Water Calorics. Look for ipsiversive slow conjugate eye movements and perhaps contraversive involuntary saccades ("nystagmus").
Control of Horizontal Vestibulo-ocular Movements

Cranial nerve III (medial rectus) nucleus

Medial longitudinal fasciculus (MLF)

Mesencephalon

Cranial nerve VI nucleus

MLF

Vestibular nucleus

Labyrinth

Cranial nerve VIII

Caudal pons

To lateral rectus muscle
Vestibulo-ocular Disorders

• General hypofunction (creates oscillopsia)
• Imbalance (creates nystagmus)
Supranuclear Gaze Palsy

- Absent voluntary gaze (saccades and pursuit)
- Intact reflex gaze (vestibulo-ocular), elicited by Doll’s Head Maneuver or Cold Water Calorics
- Means that brain stem gaze pathways are intact but cerebral gaze pathways are not intact
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