RING AROUND THE PALSY

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DIPLOPIA

Diplopia
HISTORY QUESTIONS

• Does it go away with closing one eye?

• Are there two separate images or is it just a shadow image?

• Are the images side by side or on top of each other?

• Is it better or worse in the distance?

• Is it constant?

• Any associated pain?
HISTORY QUESTIONS

- Any previous episodes?
- Have you noticed a droopy eye lid?
EXAMINATION

• Ductions:
  • Monocular -tested for completeness of motion

Versions:

  Binocular tested for symmetry

Prism and cover testing

  • must be done in all fields of gaze
  • to determine if it is comitant or non comitant
3RD NERVE PALSY

- Third cranial nerve is the oculomotor nerve
  - Functions
    - Levator muscle- lifts the lid
    - Superior rectus and the inferior oblique- elevate the eye
    - inferior rectus- depresses the eye
    - Accommodation and the pupil- constriction
3RD NERVE PATH

The Oculomotor Nerves (III)
3RD NERVE PALSY

- It is important to check all areas that the 3rd cranial nerve innervates to examine a patient for 3rd cranial nerve palsy.

- Start with the levator- check for ptosis
  - ptosis may mask the diplopia in straight ahead gaze
  - if the patient looks up and laterally in the field of the superior rectus muscle then they notice the diplopia
3RD NERVE PALSY

- Examine their pupillary response to light and accommodation
  - Dilated nonreactive pupil with ptosis and eye in the down and out position needs to be imaged ASAP
  - Could be an aneurysm, tumor, or meningitis
## Cover test

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Right</th>
<th>3rd</th>
<th>Nerve</th>
<th>palsy</th>
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<td></td>
<td></td>
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<td>6LH</td>
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<td>2 exo</td>
<td>2LH</td>
<td>6exo</td>
<td>10 exo</td>
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<td>4RH</td>
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Image of 3rd nerve palsy
Isolated Third nerve

Two Groups- External Ophthalmoplegia and Internal ophthalmoplegia
External- Motility is impaired
  *Complete- Motility is impaired in all fields of gaze except temporally- due to the 6th nerve controlling abduction
External

Incomplete
  - Partial limitation of the eye’s movement
Superior division
  - Ptosis and inability to look up
Inferior division
  - Can’t look nasally or inferior and has pupil involvement
Internal

Pupil is involved- fixed dilated minimally reactive pupil
Pupil is spared- normal pupil reaction and not dilated
Pupil is partially involved- partially dilated pupil and sluggish response
3RD NERVE PATH

The Oculomotor Nerves (III)
Image of 3rd nerve palsy

3rd nerve
3rd nerve palsy

Cranial nerve III
Causes

Pupil involved third nerve palsy-
  Most common cause is an aneurysm typically an aneurysm at the Posterior communicating artery
Pupil Sparing-
  Ischemic microvascular disease- diabetes or hypertension
  Rare cases- cavernous sinus syndrome or giant cell arteritis
Causes

Partial pupil sparing- typically microvascular disease, rarely an aneurysm
Work-up

Pupil involved partial or complete- needs an MRI to rule out aneurysm or a mass
Pupil sparing- Only need an MRI if they are younger than 50 unless they have a known history of hypertension or diabetes
90 day rule- if the palsy has not resolved or improved in 3 months
Patients that have additional cranial nerve or other neurologic abnormalities
Lab work

Sed rate if patient has signs and symptoms of giant cell arteritis
Blood pressure or HG A1C if microvascular disease is suspected but the patient has not been diagnosed with hypertension or diabetes
Follow up

If the pupil is spared- see them daily for the first 5-7 days as they can have a delayed pupillary involvement, then recheck monthly
Pupil involved with a negative MRI, follow every 4 weeks as with pupil spared group
Treatment

If the lid is drooping significantly, the diplopia will not be an issue.
If the lid is not drooping, then patching or wearing fresnel prism.
Since the third nerve innervates so many muscles, it may be difficult to Rx prism, patching may be the best treatment option.
IF after 6 months it does not resolve, consider surgery.
SNL parody
4th Nerve palsy

The fourth cranial nerve is called the trochlear nerve and innervates the superior oblique muscle.

Action of the superior oblique
- Primary- intorsion internal rotation
- Secondary - depresses the eye mainly in the adducted position
- Tertiary- abduction or lateral rotation
Clinical testing

Clinically testing Orbital CN’s

Anatomical Actions

Clinical Testing

LR₆SO₄R₃

Lateral Rectus CN 6, Superior Oblique CN 4, Rest CN 3
Symptoms

They will complaint of binocular vertical diplopia, images on top of each other or up and to the side, trouble reading and may state that objects appear tilted.

Signs - deficiency in moving the eye down and in. The involved eye is higher in primary gaze, the deviation increases if they look in the direction of the uninvolved eye or tilting their head toward the shoulder on the side of the involved eye.
Signs

Head tilt toward the shoulder on the side of the uninvolved eye decreases the deviation and the patient may present that way.

It will increase in deviation when looking toward the uninvolved eye since it will be adducted at that time.
Causes of acquired

Common - trauma, microvascular disease, congenital, MS
The reason why trauma is a common cause is due to the fact that cranial nerve 4 has the longest intracranial course of any of the cranial nerves and it is the smallest
Rare - Tumor, aneurysm, GCA
DIFFERENTIAL

CN4 Differential

- Vasculopathic
- Tumor
- Congenital
- Trauma
Trochlear nerve pathway
3 step test

Step one - determine which eye is deviated upward in primary gaze with cover test
Step two - is the upward deviation greater with left or right gaze
Step three- is the upward deviation worse with head tilt toward the left or right shoulder
Fourth nerve palsy

4th nerve palsy

Superior oblique palsy, right: vertical diplopia
Bilateral 4th nerve palsy

Hyper in the right eye with looking left and a hyper in the left eye when looking right And a V pattern esotropia the eyes cross more with looking down
Work up

CT scan of head and orbits for suspected orbital disease
BP and HGA1C for microvascular disease
Sed rate if GCA is suspected
MRI

Needed if patient is under 40 with no history of trauma and if patient is 40 to 55 with no history of hypertension or diabetes

A 4th nerve palsy accompanied with other neurologic abnormalities
Treatment

Treat the underlying issue
Patch one eye
Use Fresnel prisms
Surgical correction if problem persists greater than 6 months
James Corden

Lenscrafters
6th nerve palsy

The sixth cranial nerve is called the abducens nerve and it innervates the lateral rectus. The lateral rectus abducts the eye or turns the eye away from the midline.
Symptoms

Binocular horizontal diplopia
Worse for distance than near, because with reading the eyes need to adduct or converge
Most pronounced in direction of the impaired lateral rectus muscle
Signs

One eye does not turn outward
Patient may have a head turn toward the
Affected eye to keep their eye opposite
the field of gaze of the restricted lateral rectus to decrease
diplopia
Lack of restriction on forced-duction testing and no
proptosis
Image of 6th nerve palsy

Right 6th Nerve palsy
Causes

Common - Vasculopathic, (diabetes, hypertension, atherosclerosis) trauma
Less common - increased intracranial pressure, cavernous sinus mass, MS, sarcoidosis, stroke, GCA, Lyme disease causing a meningeal infection or inflammation
Path of the 6th nerve

Anatomy of sixth nerve

Basilar artery
Medial lemniscus
Pituitary gland
Carotid artery
Cavernous sinus
Petroclinoid ligament
Vestibular nucleus
Clivus
Pyramidal tract
VI nerve
Work up

Do the symptoms fluctuate during the day?
History of cancer, diabetes or thyroid disease?
Check BP, HGA1C, sed rate if symptomatic of GCA
Isolated Sixth Nerve Palsy/Paresis

Traumatic

Non-Traumatic

Prior history of Cancer

Yes

Age > 50 years

No

Neuroimaging

Hypertensive?

Diabetic?

Multiple Sclerosis?

No

Yes

Control systemic condition

Resolution at 3 months

- No improvement
- Worsening
- Involvement of other nerves

Yes

Regular follow up

No
MRI needed

Patients younger than 40
6th nerve palsy accompanied with pain or other neurological signs
Any history of cancer and an MRI for patients 40 to 55 with no history of vasculopathetic disease
Additional labs

Consider a Rapid plasma reagin (testing the level of antibodies for syphilis) Lyme titer and a Fluorescent treponemal antibody tests for the presence of antibodies to the bacteria that causes syphilis
Treatment

Treat underlying condition
Patch
Fresnel prism or prism in the glasses for stable deviation
Strabismus surgery if it has lasted more than 6 months
Follow up

Re-examine every 4-6 weeks
MRI if deviation increases, other neurological symptoms occur, or it persists past 3 months
Case 1

92 year old white male
  Horizontal diplopia - worse with looking to the left
  Only noticeable at distance
Medical history- HTN, diabetes, high cholesterol
No head pain, jaw claudication or increased fatigue
Case 1

Clinical testing, VA 20/25 OU EOM: limited abduction to the left
Cover test 2 esotropia in primary gaze, ortho in right gaze and 6 esotropia in left gaze
Diagnosis

Isolated 6th nerve palsy-due to microvascular disease
Case 1

The same patient presented 3 months later, he had been hospitalized for other health problems and delayed his follow up. Still had diplopia yet it had increased, he noted arm and leg weakness and fatigue and facial pains around is temple that had started a few days prior. His exam was the same except for an increase in his esotropia on left gaze, his optic nerves were healthy with no signs of ischemic optic neuropathy.
Sixth nerve palsy
Case 1

Sed rate and C reactive protein were ordered- both were elevated
Referral made to his internist for evaluation of polymyalgia rheumatica and GCA- no biopsy done due to his age and the other positive findings
Treated with 40 mg of prednisone, diplopia resolved within three days
Case 1

So even though it seemed to be a microvascular cause initially, it really was related to his vasculitis. His inflammation initially must have been low grade. His other illnesses must have exacerbated his PMR and GCA.
Case 2

70 year old white female presents with complaints of her left lid drooping and blur with looking to the left for the past month.
Her medical history was positive for hypertension which was being treated and under control. No other symptoms, no headache or eye pain,
Her EOMs were restricted in superior lateral gaze and she noticed diplopia in superior lateral gaze as well (when her lid was lifted)
Case 2

Her vision was 20/25, her pupils reacted normally to light and she did not have an APD. Her DFE was unremarkable.

She was 6 exo at distance and 16 exo at near in primary gaze. Her cover test in the superior lateral gaze was neutralized with 5 base up prism and 4 base in.
Isolated 3rd nerve palsy of the superior division. It had already been over one month so the likelihood of developing pupil involvement was slim. Due to her age and history of hypertension, diagnosis of third nerve palsy due to microvascular disease was made. Her lid ptosis eliminated the diplopia so no treatment was given.
Follow up

One month later, her ptosis was the same, slight improvement in her diplopia. She neutralized with 4 base up and 3 base in in superior lateral gaze. She stated she wanted to wear a patch when she went out now due to not trusting what she was seeing with her OS. She is to return in one month, if no improvement, I will order an MRI.
Case 3

A 57 year old white man complains of diplopia after falling from a stool while changing a light bulb. He fell and hit his head on the tiled floor, lost consciousness and woke up approximately one minute later with diplopia. At the ER, he had a normal MRI and CT scan. Presented to an eye clinic with vertical diplopia that worsened on left gaze and improved on left head tilt. It also worsened with reading.
Medical history was negative for HTN or diabetes. Positive for osteoarthritis. VA and pupils were normal. 18 diopters of Right hypertropia that increased to 25 diopters with left gaze and 25 diopters with right head tilt. It improved to 10 diopters with left head tilt.
Case 3
Case 3

Slit lamp exam and DFE were normal.
Diagnosis

Traumatic Right cranial nerve 4 palsy
Was treated with patching and resolved within 3 months.
Remember Cranial nerve four has the longest intracranial course and exits the brainstem dorsally. As a consequence, it is susceptible to damage in head trauma.
2013 study

Reviewed the records of 109 patients with isolated cranial nerve three, four and six palsy and found 85% of the cases were due to microvascular disease. When the majority of patients present with these isolated palsy, they will be due to microvascular disease. Although a careful exam must be done to rule out other more critical causes.
A careful history and exam can point you to the correct cranial nerve palsy diagnosis.