Neurologic Exam of Infants

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Background

People focus on either

- Tone / Prims
- Behavior

34 items

- 6 categories
  - Tone, Tone Patterns, Reflexes, Movements, Abnormal Signs, and Behavior
Background

- 10-15 mins
- 96%+ interrater reliability even with inexperienced practitioners
- 2/3 of the way between feeds is the easiest state
History

- Prenatal Exposure

- Ask if the child is currently ILL
- Ask if they suffer from convulsions
- Ask what medications they are on
- Determine post natal age and post gestational age
- Don’t Forget Peripheral Nerve Lesions!
Observation

1. Observation

- Head
- Trunk
- Extremities
- Spontaneous movements
- Abnormal pattern of movements of respiratory muscles
- Joint contractures
- Trauma
- Malformations
- Head Circumference
- Size of the fontanel
Behavior-

Normal

- 5 day old infant - alert, quiet state body in flexion
- Spontaneous movements, smooth flowing quality.
- Not excessive, jerky or asymmetric
- Attentive to the environment
- Making attempts to organize and comfort himself by sucking fists.
- Behavioral response to light – habituation with repeated stimulus
- Responds to sound of the bell

Abnormal

- 3 week old infant – eyes closed, drowsy state.
- Body is in slight flexion
- Transition into awake state and maintains eyes open but movements are not vigorous.
- Responds to light and sounds and has some habituation.
- Lack of spontaneous facial and extremity movements is abnormal
- There is grimace to light so there is reflexive movements

Behavior

Normal

Abnormal
Cranial Nerve

- Examination of the baby’s cranial nerve function is often accomplished by observing spontaneous activity. During crying, facial movement (Cranial Nerve 7) is observed for fullness or asymmetry.
- The quality and strength of the cry is a way of looking at the Cranial nerves 9 and 10 function.
- Sucking and swallowing assesses cranial nerves 5, 7, 9, 10 and 12 because all of these cranial nerves are involved in this complex act.
- Eye movements (cranial nerves 3, 4 and 6) can be assessed by using the Vestibulo-ocular reflex (doll’s eyes maneuver).
- When the head is turned, there is conjugate eye movement in the opposite direction. Testing a baby’s behavior response to light (cranial nerve 2) and sound (cranial nerve 8) also adds to the cranial nerve exam.
- Pupillary light reflex, corneal reflex, gag reflex and funduscopic exam are done in the same manner as the adult exam.
Head Shape and Sutures – palpate the sutures and outline the anterior and posterior fontanelles. Head should be closely inspected as a part of neurological examination.

Normal
- Head should be closely inspected as a part of neurological examination.
- There can be molding of the head which is an expected finding in a newborn.
- Bifrontal and biparietal diameter are usually the same.

Abnormal
- Abnormality noted is that the bifrontal diameter is less than the biparietal diameter.
Head Circumference – head circumference measurement should be plotted on a standardized head growth chart for the appropriate sex.

**Normal**
- Important to measure the head circumference, which sometimes is referred to OFO (occipital-frontal circumference) because the measurement is obtained by placing the measuring tape around the most prominent aspect of the frontal and occipital bones.

**Abnormal**
- 34.6 cm is 25th percentile
- Measuring the head circumference in this baby is very important because of his findings of central or cerebral hypotonia.
- Reflects that the hypotonia is from an upper motor neuron problem.
- Main diagnostic considerations for this baby are a congenital brain malformation, a chromosomal abnormality or an inborn error or metabolism.
Tone

Posture and Tone

Upper Extremity

- Noting the tone of the limbs in the supine position, ventral suspension, response to traction of the upper and lower limb with the infant in the supine head position

- To elicit, arm traction the arm is pulled slowly to a vertical position by the wrist.

- The resistance and the angle of flexion at the elbow is noted when the shoulder lifts from the surface.

- Tone is resistance to passive stretch!
Tone - Upper Extremity

- **Normal Tone**
  - Assessing begins with passive range of motion (ROM).
  - Rotating each extremity at the shoulder, elbow and wrist feeling the resistance and ROM.
  - Too little or too much resistance reflects hypotonia or hypertonia.

- **Abnormal Tone**
  - Keep head at midline
  - Little to no resistance

**UE Tone**

**Normal**

**Abnormal**
UE Tone – Arm Traction

Arm traction done with baby in the supine position. Wrist is grasped and the arm is pulled until shoulder slightly off the mat

- Normal Tone
  - There should be some flexion maintained at the elbow.

- Abnormal Tone
  - With the arm traction there is less resistance, and the arm is more extended than normal
  - Full extension is seen in hypotonia

Arm Traction

Normal

Abnormal
**UE Tone – Arm Recoil**
Tests tone and action of the biceps. Arms are held in flexion against the chest for five seconds, then quickly extended and released.

- **Normal Tone**
  - Arms should spring back to the flexed position.

- **Abnormal Tone**
  - When arm recoil is tested there is very little recoil. This indicates decreased tone in the bicep muscles.
  - Asymmetry to this response with lack of recoil would be seen with Erb’s or brachial plexus palsy.

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**Arm Recoil**

**Normal**

**Abnormal**

![Normal Arm Recoil](image1)

![Abnormal Arm Recoil](image2)
UE Tone – Scarf Sign

The tone of the shoulder girdle is assessed by taking the baby’s hand and pulling the hand to the opposite shoulder like a scarf.

Normal Tone
- The hand should not go past the shoulder and the elbow should not cross the midline of the chest.
- There should be resistance

Abnormal Tone
- The scarf maneuver demonstrates low shoulder girdle tone.
- Hand actually can be pulled beyond the opposite shoulder and the elbow goes past midline.

Scarf Sign

Normal

Abnormal
UE Tone – Hand Position
Rubbing the ulnar aspect of the hand or touching the dorsum of the hand will often cause extension of the fingers.

Normal Tone
- Newborn baby’s hand is held in a fisted position with the fingers flexed in a tight fisted position.
- Over the first 1 to 2 months of life, the baby’s hand becomes more open.
- Persistence of a fisted hand is a sign of an upper motor neuron lesion in an infant.

Abnormal Tone
- The baby’s hand is not in the typical closed or fisted position.
- It is open with more extension of the fingers and thumb than usually seen at this age. This is consistent with hypotonia.

Posture and Tone

Test Each Arm and Leg individually

Lower Extremity

<table>
<thead>
<tr>
<th>Leg Traction</th>
<th>Resistance to this maneuver and the angle of flexion at the knee are noted when the buttock becomes elevated</th>
</tr>
</thead>
<tbody>
<tr>
<td>is elicited by raising the leg into vertical position by gentle traction on the ankle.</td>
<td></td>
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</tbody>
</table>

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Tone – Lower Extremities

Begins with passive range of motion. Flexing the hips, then abducting & adducting the hips. Next flex and extend the hips, knees and ankles.

Normal Tone
- Assessing motor function of the lower extremities begins with passive range of motion.
- Flexing the hips, then abducting & adducting the hips. Next flex and extend the hips, knees and ankles.
- Further testing helps to better define the tone and any tone abnormalities.

Abnormal Tone
- Increased range and less resistance on passive range of motion at the hips, knees and ankles.
- The hips can be abducted almost to the mat.
- The legs can be extended to far at the hip and knee.
- Ankle tone is diminished, which can be demonstrated by flexing & extending the ankle and shaking the foot.

LE Tone

Normal

Abnormal
LE Tone – Leg Traction
Leg traction is done by holding the leg by the ankle. Leg is pulled upward until the buttock starts to be lifted off the mat.

Normal Tone
- There should be resistance when leg is pulled upward
- The knee should maintain a flexed angle.

Abnormal Tone
- Full extension of the knee with little resistance to pulling on the leg is a sign of hypotonia.

Leg Traction

Normal

Abnormal
LE Tone – Leg Recoil
To test leg recoil, legs are fully flexed on the abdomen for a few seconds, then the legs are quickly extended and released.

**Normal Tone**
- The legs should spring back to the flexed position after being quickly extended
- Legs that remain extended could be due to either hypotonia or abnormal extensor tone

**Abnormal Tone**
- If there is only partial recoil that reflects low tone.

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**Leg Recoil**

**Normal**

**Abnormal**
LE Tone – Popliteal Angle
Assessment of the tone of the hamstring muscles. It is done one leg at a time

Normal Tone
- Thigh is flexed on the abdomen with one hand and then the other hand straightens the leg by pushing on the back of the ankle until there is a firm resistance to the movement.
- The ankle between the thigh and leg's typically about 90 degrees.

Abnormal Tone
- Extension of the leg beyond 90 to 120 degrees would be seen in hypotonia.
- The popliteal angle is about 160 degrees and should be about 90, indicating low tone in the hamstring muscles.

Popliteal Angle

Normal

Abnormal
LE Tone – Heel to Ear
Holding the baby’s foot in one hand, draw the leg towards the ear to see how much resistance there is to the maneuver.

**Normal Tone**
- The foot should go to about the level of the chest or shoulder, but not all the way to the ear.

**Abnormal Tone**
- If the foot can be drawn to the ear then there is hypotonia.

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Heel to Ear

**Normal**

**Abnormal**

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Posture and Tone of Truck and Neck

Head Control in the Sitting Position

- Place infant into the sitting position and child it there by encircling the infants chest with your hands.
- Allow head to fall forward or backward
- Ability to raise the head to vertical is noted

Head Lag

- Head lag while the infant is pulled to the sitting position
  - Grasping the infants wrist and gently pulling the infant from the supine toard the sitting position
  - Record response of the head

Posture of the Head in Suspension

- Posture of the head and trunk in ventral suspension
  - Suspend the infant in the prone position by a hand under the chest
  - Posture of the head in relation to the trunk is scored and the amount of flexion in the arms is also noted

Neck Tone – assessed by passively rotating the head towards the shoulder.

Normal
- Chin should be able to rotate the shoulder but not beyond the shoulder.
- If the chin goes beyond the shoulder there is hypotonia of the neck muscles, which is associated with poor head control.

Abnormal
- On passive rotation of the head from shoulder to shoulder, the chin goes past the shoulder on each side
- This confirms low tone in the neck muscles.
**Neck Tone**

**Normal**
- The arms should remain partially flexed at the elbow and the head may lag behind the trunk but should not be fully flexed backwards.
- When baby is in sitting position, head should be able to come upright position for at least a few seconds before dropping forward or backwards.

**Abnormal**
- Pulling the baby from supine to sitting demonstrates significant head lag.
- Arms are fully extended so there is no pulling or resistance with traction.
- Unable to bring head to the upright position once in sitting position.

**Head Lag** — starting in supine position, baby pulled by the arms to the sitting position. The head and arms are observed during the maneuver.

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Head Lag

**Normal**

**Abnormal**

Head Control – the strength and tone of the neck extensors can be tested by having the baby in sitting position and neck flexed so the baby’s chin is on the chest. Neck flexors tested by having head in extensions while in sitting position.

**Normal**

- Baby should be able to bring the head to upright position from extension
- Baby should be able to bring the head to upright position from flexed position

**Abnormal**

- With neck flexed cannot raise his head which indicates weakness of the neck extensors.
- With neck extended cannot raise his head which indicates weakness of the neck flexors.
Head Control

Normal

Abnormal

Positions

- Prone
- Ventral Suspension
- Vertical Suspension
Prone Position

Normal
- Baby should be able extend the neck to the point where head can be turned side to side.
- When the arms are extended by the side of the trunk, the baby should be able to bring them forward into a flexed position.
- Buttocks should be somewhat elevated because the hips are flexed and adducted.

Abnormal
- Baby that is flat on the mat and cannot turn the head back and forth has low tone and weakness.
- Hips are too adducted so his pelvis is flat on the mat and does not bring his arms forward.
- Overall fewer spontaneous movements than he should have.
Ventral Suspension – baby is placed in prone position, suspended in the air by the hand placed under the chest. The baby’s head position, back and extremities are observed. This is a great way to assess a baby’s neck and trunk tone.

**Normal**

- Head should stay in the same place as the back.
- The back should show some resistance to gravity and not be simply draped over the hand on the chest.
- The extremities should maintain some flexion tone and not dangle in extension.

**Abnormal**

- Head is on chest and is not kept in the same plane as the back.
- Trunk is too rounded and the extremities are extended.
- Some effort to straighten his back so there is some strength but the effort is less than it should be.
Maturation of Tone

- Posture / Tone are age dependent
- Increased flexor tone with age
- Increased Axial tone with age
- Global Tone scores as well as comparative to each limb
- Axial vs Limb Tone

- Neck Flexor Tone can be tested at 28 weeks gestation
- Neck Extensor Tone needs to be at full term

Assessment of Tone Patterns

<table>
<thead>
<tr>
<th>Predominance of extensor tone compared to flexor tone</th>
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| • Comparing ventral suspension and head lag or neck flexor and extensor muscles in the two items assessing head.  
• Normally associated with hypoxic-ischemic lesions, meningitis, or increased intraventricular pressure. |

<table>
<thead>
<tr>
<th>Differential distribution of tone in upper and lower limbs</th>
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</table>
| • Compare the tone in the uppers and lowers  
• Leg tone abnormalities = breech presentation or in normal crying infants  
• If noted in quite infant consider CNS pathology such as intraventricular hemorrhage or periventricular leukomalacia, hypoxic-ischemic encephalopathy with severe basal ganglia lesions. |

<table>
<thead>
<tr>
<th>Relatively tight popliteal angle compared to leg traction</th>
</tr>
</thead>
</table>
| • Compare popliteal angle to leg traction  
• Tight popliteal angle associated with relatively poor resistance on leg traction can be associated breech presentation  
• Disproportionately tight popliteal angle compared with the rest of the leg tone is frequently found in association with germinal matrix or intraventricular hemorrhage. |
Neuromuscular Disorders

- Generalized Hypotonia in the new born is associated with muscle weakness
- Best assessed using anti-gravity movements
- Key finding may be no change in muscle strength to PAIN or when CRYING
- Contractures, Skin Dimpling, Poor dermatoglyphic patterns are all indicators of poor fetal movements.
- Absence of Reflexes in a floppy infant strongly suggest a severe motoneuron disorder

Vertical Suspension — Examiner holds the baby in the upright position with feet off the ground by placing the hands under the arms and around the chest.

**Normal**
- Baby should be suspended in this position without slipping through the hands of the examiner.

**Abnormal**
- If there is shouldn’t girdle weakness the arms will extend upwards and the examiner will have to reposition their grasp of the baby to avoid the baby slipping through the hands.
- It feels like trying to hold on to a slippery fish
Vertical Suspension

Normal  Abnormal

Reflexes
Reflexes

- Primitive Reflexes have been a staple of Neuro exam of the infant for a long time.
- Experience is kids who are grossly deformed can have regular reflexes and kids who are normal can have some abnormal reflexes
- Need to use in conjunction with other findings

Deep Tendon Reflexes

- Testing deep tendon reflexes is an important part of the newborn neurological exam. Can be difficult to do.
- Use a reflex hammer, not a finger or a stethoscope.
- Ideally baby is in a quiet alert state with head in midline. Head turned to one side can reinforce the tone and reflexes on that side.
- Recommended to start with the knee jerk because is the easiest to obtain.
- Take control of the leg with the hand under the knee and the leg at about 90 degree angle at the knee. Then strike the patellar tendon with the reflex hammer using pendular action rather than a chopping action.
- Next is ankle jerk. If unable to get, place fingertip on the plantar aspect of the foot, flex the foot slightly, then strike the back of the finger.
- Bicep jerk have arm flexed at the elbow, thumb over the bicep tendon, then strike the thumb with a pendular action. Because of the predominately flexor tone of the newborn, it is rare to obtain a triceps jerk.
Deep Tendon Reflexes cont...

- Absence of a deep tendon reflexes is a much more important finding than hyperreflexia in the newborn.
- A normal newborn can have hyperreflexia and still be normal, if the tone is normal, but absent reflexes associated with low tone and weakness is consistent with a lower motor neuron disorder.
- Persevered or exaggerated reflexes associated with low tone is the hallmark of what is called central or cerebral hypotonia and the cause is upper motor neuron lesion.

Deep Tendon Reflexes

Normal

Abnormal
Plantar Reflex

Normal

- Normal response to stroking the lateral aspect of the plantar surface of the foot is extension of the great toe and fanning of the other toes.
- If stimulus is brought across the ball of the foot then a grasp reflex will be elicited and the toes will plantar flex.
- The up going toes or "Babinski sign" is normal in the infant and may be present for the first year of life because of the incomplete myelination of the corticospinal tracts.

Abnormal

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Suck, Root Reflex — Root reflex is obtained by gently stroking the cheek towards the lips.

**Normal**
- Baby should have a strong coordinated suck reflex with good stripping action of the tongue.
- Should be resistance to pulling out the pacifier.
- Baby should open the mouth towards the stimulus and turn the head to latch on to the object.

**Abnormal**
- Some sucking but it is not as vigorous or sustained as it should be.
- Pacifier can be easily pulled from the mouth.
- There is no root reflex which indicates problems with feeding.

Suck and Root Reflex

**Normal**

**Abnormal**
Moro Reflex – obtained by holding the baby’s head and shoulders off of the mat with the arms held in flexion on the chest. Examiner suddenly lets the head and shoulders drop back a few inches while releasing the arms.

Normal

- Arms should fully abduct and extend, then return towards the midline with the hand open and the thumb and the index finger forming a “C” shape.

- Absent or incomplete moro is seen in upper motor neuron lesions.

- Asymmetric Moro is most often seen with a brachial plexus lesion. The brachial plexus palsy is on the side of the poorly abducted arm.

- Baby has a Moro reflex with the arms fully abducted and extended but he does not bring the arms back to midline. So the Moro is present but not as complete as it should be.
Galant Reflex — (trunk incurvation) is obtained by placing the baby in ventral suspension, then stroking the skin on one side of the back.

Normal
- Baby’s trunk and hips should swing towards the side of the stimulus
Stepping Reflex — stepping or walking reflex is obtained by holding the baby upright over the mat with the sole of the foot touching the mat. This initiates a reciprocal flexion and extension of the legs and it looks like the baby is walking.

Normal
Abnormal

Grasp — placement of the examiner’s fingers in the palm of the hand or on the sole of the foot will cause flexion and grasping of the fingers and toes.

Normal
- One should avoid touching the dorsum of the hand while eliciting the grasp reflex because stimulating the back of the hand causes a hand opening reflex to occur.
- With two competing reflexes the grasp response will be incomplete or inconsistent.
- Grasp reflex can be reinforced by applying traction on the arm.

Abnormal
- Weak non full grasp indicated the reflex is there but not as pronounced as it should be.
Grasp Reflex

Normal

Abnormal

Movements
Movements

- Optimal Time / Position
  - Supine
  - Awake
  - Quiet

- Both quantity and quality of spontaneous movements are noted.
- Must observe anti-gravity movement as this is an important sign in the differential diagnosis of floppy infants.

- Pay attention to abnormal movements such as
  - Eye movements
  - Twitching
  - Jitteriness
  - Convulsions
  - Hypo-glycemia

Maturation of Movements

- Premature
  - Stretching and twisting of trunk and limb
  - Repetitive wide-amplitude movements of limbs
  - Looks like myoclonus
  - At term, these babies will have more jerky movements, tremors, and startles than term infants

- Term
  - Become smooth
  - Alternating movements with arms and legs
Neurobehavioral Items

- **Visual**
- **Auditory**
- **Eye Movements**
- **Quality of Cry**

Maturation of behavioral items

- **Eye Movement**
  - Even Prior to 32 weeks gestational age some infants can focus on a target
  - Can not usually track
  - After 32 weeks many babies can track horizontally or vertically
  - After 36 weeks many can track in an arc pattern

- **Auditory**
  - Can be elicited from 27-28 weeks post menstrual age and becomes stronger with age

- **Cry**
  - High pitch or weak can be a sign of abnormal neurologic state
Abnormal Signs

- Foot / Hand posturing
- Tremors
- Startles
Scoring

- Use the provided criteria for scoring
- Objective testing and objective scoring for the family post intervention
- Can suggest improvement or deterioration
- Optimality Score?
Full Term Infant with neonatal encephalopathy

- Increase in extensor tone in the legs and flexion in the arms
- Prevalent extensor tone in the neck and truck muscles
- Either is associated with diffuse lesion involving the cortex, white matter or basal ganglia.
3 Months - Behavior

- Baby almost 3 months old.
- Alert and attentive to the environment and the examiner.
- Lots of social presence and able to smile and frown.
- There is definite social awareness and interaction.

3 Months – Cranial Nerves

- The vestibulo-ocular reflex evokes a full range of conjugate eye movements.
- The baby should also be able to visually track 180 degrees in the horizontal plane. Facial expression is full and symmetric.
3 Months – Upper Extremity Tone

- In the newborn flexor tone is predominate. After the first few weeks, the flexor tone is less.
- Passive range of motion is still met with resistance but with the appropriate amount.
- The hand pulled across the body to the opposite shoulder still does not extend beyond the shoulder.

3 Months – Hand Movements

- The hand is now held in a more open position.
- The infant will hold on to an object when placed in his hand but will not yet reach for the object.
- At this age, the infant may start to bat at objects.
- He also watches his hands.
3 Months – Lower Extremity Tone

- Tone in the lower extremities is present with the appropriate resistance to passive range of motion.
- The tight flexor tone of the newborn is no longer present.

3 Months – Head and Trunk Control

- When pulled to a sitting position, a baby this age should be able to have only slight head lag and, when sitting, the head should be upright but there may still be wobbling of the head.
- The back is still rounded, so the baby slumps forward.
3 Months – Supine

- In a supine position, the baby’s extremities are held off the mat and there is spontaneous movement in all extremities.
- During the first 3 months of life, babies will often lie with their head turned to one side or the other.
- This may be associated with extension of the arm that the head is turned towards.
- This part of the asymmetric tonic neck reflex, which is most prominent during this time but diminishes by 3 to 4 months of age and is gone by 6 months of age.

3 Months - Prone

- In the prone position, the baby is now able to bring his head up and look forward with the head being 45 to 90 degrees off the mat.
- Weight is borne on the forearms. When the head and chest are well off the mat, the baby is ready to start to roll from the prone to the supine position.
- Rolling front to back usually occurs at 3 to 5 months of age.
- Rolling over too early can be due to excessive extensor tone.
3 Months – Ventral Suspension

- In ventral suspension, the baby’s posture is very similar to the prone position.
- The trunk and legs are in the same plane and the back is kept straight.
- The head is above the body looking forward. The baby is able to maintain a forward-looking position.

3 Months – Vertical Suspension

- In vertical suspension with the feet touching the mat, the baby should start to support some weight with his legs.
- Bearing weight on the legs is the earliest postural reflex to appear and usually is present at 3 to 4 months of age.
- The baby’s shoulder girdle is strong and there is no slipping through the examiner’s hand.
3 Months – Deep Tendon Reflexes

- One of the main obstacles to obtaining deep tendon reflexes at this age is catching the extremity at rest.
- Positioning the extremity is also important.
- As demonstrated in this baby, a crossed adductor can be seen at this age and still be normal but should not persist beyond 7 months of age.
- A few beats of ankle clonus can be normal in the first few weeks of life but sustained ankle clonus at any age is abnormal.

3 Months – Plantar Reflex

- Stroking the lateral aspect of the plantar surface of the foot still elicits a strong “Babinski sign” which is an up-going great toe and fanning of the other toes.
3 Months – Root Reflex

- The baby still has a root reflex and turns the mouth towards the stimulus.
- The rooting reflex disappears at about 4 months of age.

3 Months – Moro Reflex

- The baby no longer has a Moro reflex
- Usually the Moro reflex is absent by 4 to 5 months of age.
- Persistence of the Moro reflex beyond this time can be seen with upper motor neuron disorders.
3 Months – Galant Reflex

- The Galant reflex is still present but should diminish and be gone by 4 months.

3 Months – Grasp Reflex

- The palmar grasp reflex is still present for this baby.
- The grasp reflex is usually gone by 4 to 6 months of age for the hands and 6 to 12 months for the toes.
- The reflex palmer grasp is gradually replaced by the voluntary activity of reaching and grasping with the hand.
3 Months – Asymmetric Tonic Neck

- The asymmetric tonic neck reflex is present in the first 3 to 4 months of life. When the head is turned to the side, the ipsilateral arm and leg will extend while the contralateral extremities will be in flexion.
- The baby should be able to overcome this reflex and move out of this posture.
- If the asymmetric reflex is obligate (the infant can not move out of or overcome the reflex) or if the reflex persists beyond 6 months of age, then it is abnormal and can be seen in upper motor neuron disorders.

6 Months - Examination
6 Months - Behavior

- The baby is sitting comfortably in his mother's lap. He is socially aware, inquisitive and readily responds to visual objects and sounds.
- He smiles, laughs and jabbers.
- At this age a baby will start to make repetitive speech sounds that are nonspecific such as da, ma or ba.

6 Months – Cranial Nerves

- The baby is able to visually track an object throughout the horizontal and vertical planes. An interesting or colorful object is most helpful.
- To test visual fields, have the baby focus on an object in front of him and then bring a second object from behind him until he sees the object in front of him and then bring a second object from behind him until he sees the object in his peripheral vision.
- He should turn toward the new object. Saccadic eye movements are tested by using interesting toys and sounds and watching the eyes jump from object to object. To test hearing, produce a sound out of the baby's sight and then watch the baby turn and localize the sound.
- Facial movements are noted as the baby smiles or cries.
6 Months – Motor Sitting

- Independent sitting is accomplished by a 6 to 8 months. This baby has good sitting posture (head erect and spine straight) and has enough stability to reach for objects with both hands.
- He even stretches to obtain an object without losing his balance.

6 Months – Motor - Hand

- The baby is able to reach out and pick up an object and bring it back to the midline, usually to his mouth. He reaches equally well with either hand. Hand preference before one year of age is always abnormal and indicates a motor deficit in the non-preferred hand.
- At this age, the baby is able to transfer an object from hand to hand. By 5 to 6 months, a baby grasps objects that are the size of a cube. An ulnar or palmer grasp is raking motion with the fingers trapping the object against the palm.
- The next stage of hand development is to use the thumb in concert with the fingers to grasp an object. This is called a whole hand grasp. The baby is starting to use the thumb so has a developed a whole hand grasp. A thumb-finger pincer grasp develops at 7 to 9 months.
6 Months – Motor - Tone

- Tone is assessed for the upper and lower extremities by passive range of motion when the baby is cooperative.
- Distraction is a great way to get that cooperation.
- Babies at this have found their feet and can suck on their toes.
- On passive range of motion, the lower extremity should be flexible enough to bring the foot to the baby’s mouth. There shouldn’t be any ankle clonus.

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6 Months – Motor - Tone

- On traction, which is pulling to a sitting position, the baby has good head and trunk control.
- The head and shoulders are flexed and the arms are flexed. The baby actively helps himself to get to the sitting position by pulling with the arms.
- Also notice that the legs are flexed at the hips and are off the mat as the baby pulls himself to sitting.
- On being laid back down to the supine position, the baby doesn’t flap back, but is able to control the lowering of his head and trunk to the mat.
6 Months – Position - Prone

- In the prone position, the baby brings his chest all the way off the mat and supports his weight on his hands, not his forearms. He works for toys out of his reach. He is close to crawling.
- He can roll over from front to back and back to front.

6 Months – Deep Tendon Reflexes

- It is hard to get the baby relaxed and cooperative enough to get the limb in the optimal position for obtaining deep tendon reflexes.
- At this age, all the deep tendon reflex tests in an adult exam should be obtainable.
6 Months – Plantar Reflex

- There is still a lot of plantar grasp at this age as well as withdrawal, which makes testing for the plantar response difficult at this age.
- The toes are still up going until one year of age.
- The most useful finding at this age is if there is asymmetry in the toe findings.

6 Months – Primitive Reflexes

- At 6 months of age this baby has lost the Moro reflex and the asymmetric tonic neck reflex.
- Persistence of either one of these primitive reflexes would be abnormal.
6 Months – Positive Support Reflex

- Some consider the positive reflex as a primitive reflex, but others consider it a postural reflex.
- It is necessary for erect posture and blends into volitional standing.
- Infants with prenatal or perinatal corticospinal tract disease will often refuse to support their weight on their feet.
- The positive support reflex is the first postural reflex to develop and is present by 3-4 months of age. When the baby is placed in vertical suspension with the feet touching the mat, the baby will extend the legs and attempt to support his weight being balanced by the examiner. By 5-6 months of age the baby fully supports his weight while standing and by 7 months enjoys bouncing.

6 Months – Postural Reflex - Landau

- The landau is an important postural reflex and should be developed by 4-5 months of age.
- When the infant is suspended by the examiner’s hand in the prone position, the head will extend above the plane of the trunk. The trunk is straight, and the legs are extended so the baby is opposing gravity.
- When the examiner pushes the head into flexion the legs drop into flexion.
- When the head is released, the head and legs will return to the extended position.
- The development of postural reflexes is essential for independent sitting and walking.
6 Months – Postural Reflex - Lateral Propping

- Lateral propping or protective extension is essential for the baby to be able to sit independently.
- This postural reflex develops 5-7 months of age.
- Anterior propping actually develops first, then lateral propping.
- For anterior propping the baby will extend the arms forward to catch himself and prevent falling forward.
- Lateral propping occurs when the baby is falling to one side or the other and he extends the arm laterally to catch himself.
- Asymmetric lateral propping can be early sign of hemiparesis. The baby will prop on one side but on the paretic side he will not extend the arm to catch himself.

6 Months – Postural Reflex - Parachute

- The parachute reflex is the last of the postural reflexes to develop.
- It usually appears at 8-9 months of age.
- When the baby is turned to face down towards the mat, the arms will extend as if the baby is trying to catch himself. Prior to developing this reflex, the baby will bring the arms back to the plane of the body and away from mat.
6 Months – Head Examination

- The head circumference should be measured and plotted. This is usually done at the end of the exam because babies usually resent the restriction of the head movement necessary to obtain an accurate measurement. Head shape should be noted, and the sutures palpated.

- Craniosynostosis (premature closure of the suture) can cause a misshapen head. Bone growth occurs perpendicular to the suture. If one suture is closed, compensatory growth will occur in the remaining open sutures. Synostosis of the sagittal suture (the most common type of synostosis) results in scaphocephaly (a thin elongated head.) Synostosis of the coronal sutures results in brachycephaly (a wide flat head). Synostosis of the metopic suture results in trigonocephaly (a triangle shaped head).

- The most common cause of a misshapen head is flattening of the occiput on one side and is not from lambdoid synostosis but is positional in nature (caused from the baby lying supine with the head tuned to one side as a preferred position).

6 Months – Head Examination

- It is important not only to palpate the sutures but also the fontanelles. The posterior fontanelle cannot be palpated after 6 weeks.

- The anterior fontanelle is often small by 6 months. Closure of the anterior fontanelle occurs between 10 and 20 months.

- The anterior fontanelle should be palpated while the child is sitting and quiet and it should be flat or slightly concave. A full, slightly bulging fontanelle can be seen with a child that is supine or crying.
12 Months – Behavior - Shy

- Infants at 12 months of age are often and have stranger’s anxiety. Most of the neurological exam can be performed with the child on his parent’s lap.
- The parents helps reassure the child and facilitates the exam.
- This infant is shy and frequently looks to his father for reassurance.
- The examiner uses toys to try to engage the child in play and overcome the shyness.

12 Months – Behavior Social and Language

- Infants this age imitate activities, wave bye-bye, and play pata—cake. They can follow simple instructions especially if they desired action is demonstrated.
- They feed themselves finger foods.
- They usually have one or two meaningful words, usually mama and dada.
12 Months – Cranial Nerves

- A colorful finger puppet is used to attract the infant’s attention and test extra ocular range of movement.
- For testing visual fields, a finger puppet is used again used to get the infant to visually fixate, and then a dangling measuring tape is used to test peripheral vision.

12 Months Motor - Tone

- Passive range of motion for both the upper and lower extremities is tested.
- Transforming the movements into a game makes the exam less threatening to the infant.
12 Months – Deep Tendon Reflexes

- A reflex hammer can be a threatening object to the infant. By turning the reflex hammer into an imaginary horse and adding sound effects, the infant is not threatened and cooperates for the exam.
- Because using a reflex hammer can be a threat to the child, deep tendon reflexes are usually done late in the exam and when the child is on the parent’s lap.

12 Months – Plantar Reflex

- At 12 months of age the toes can go up or down.
- Generally they are down going. In this age group it’s hard to not get withdrawal of the foot. An abnormality of the plantar reflex is most diagnostic if there is reproducibly asymmetry.
12 Months – Motor/Postural Reflexes - Parachute

- The parachute is the last of the postural reflexes to develop. It usually appears at 8 to 9 months and certainly is presented by 12 months of age.
- The reflex is elicited by turning the child upside down.
- The arms should come forward and the hands spread out to catch the fall.
- Asymmetry of the reflex is abnormal and may indicate paresis in the non-extended extremity.

12 Months – Pincer Grasp

- Fine motor coordination of the hand progresses in a definite pattern. At 6-7 months the hand is used as a rake and objects are raked into the palm with the fingers.
- At 8-9 months the thumb and the radial fingers are used to grasp an object and smaller objects are picked up.
- At 10-12 months, the fine pincer grasp is developed. This enables an infant to pick up a small object between the distal and index finger.
- Both infants in this exam have developed a pincer grasp. The first infant uses the pincer grasp to feed himself a cheerio. The second the infant demonstrates a pincer grasp by grabbing the tip of a measuring tape and pulling the tape out.
- The pincer grasp should be equal in either hand. Handness does not develop until after 12 months of age.
- Early handedness and asymmetric fine motor skills are seen with a hemiparesis.
12 Months – Motor/Coordination – Beads in the cup

- This test is a combination of understanding instructions, as demonstrated, and using a pincer grasp to place the small beads in a container.

12 Months – Motor/Coordination – Play Ball

- This infant plays the simple game of throw the ball.
- His throw is not an overhand throw which is seen in an 18 month old but rather a pushing away and dropping type of throw that is typical for this age.
12 Months – Motor – Transition in and out of Sitting

- As far as gross motor skills, the infant is able to get in and out of the sitting position with ease and creeps well.

12 Months – Motor – Creeping

- Crawling is a commando type of crawl which is an arm over arm propulsion forward with the trunk on the ground and legs dragging.
- Crawling is usually seen at 7 – 9 months.
- Creeping is crawling on hands and knees with trunk off of the ground. Creeping is usually seen at 8 to 12 months.
12 Months – Stoop and Recover

- At one year, this infant has developed the ability to walk without support. Although still wobbly, he can stoop down to pick up an object and stand back up without falling. He can maintain his balance as he inspects and manipulates the toy.
- An infant usually develops the ability to stoop and recover at 11 to 14 months of age.

12 Months – Motor/Gait – Stand, Walks with support

- The first infant demonstrates the ability to pull himself to a stand while holding on.
- The second infant can stand, pull to a stand and cruise (not demonstrated because the baby is upset.)
- Cruising is walking along a piece of furniture while holding on. It usually develops between 10-12 months. Along with cruising, the infant can take steps while holding on but he’s not ready to walk unsupported.
12 Months – Motor/Gait – Toddler’s Gait

- Independent walking is achieved between 11 and 15 months of age. An infant is delayed if they aren’t walking by 16 months. This 12 month old has a typical gait of an infant that has just learned to walk. He has a wide base is unsteady and toddles.

- His arms are held at near shoulder level in a high guard position. This is a protective position and probably aids in his balance. As he matures, his arms will come down to a low guard position, then into the usual associated arm movements seen with mature walking.

12 Months – Head Circumference

- The first attempt to measure the head circumference is easy but the examiner reads the measurement as 50.6cm, which is above the 98th percentile.

- Second attempt is much more difficult because the infant doesn’t want the tape measure around his head.

- The measurement however is read at 47.7cm, which is at the 50th percentile.

- A third attempt verifies that the 47.7 cm measurement is correct. Always take at least two measurements and save the head circumference to the last.