Neonatal Hypotonia

Clinical Approach to Floppy Baby

Hypotonia in the newborn is a common presenting feature of systemic illness or neurologic dysfunction at any level of the central or peripheral nervous system. It is defined as reduced resistance to passive range of motion in joints.

**Etiology: diverse**

Causes include (but are not limited to):

| Central (most common) | • Sepsis  
• Hypoxic ischemic encephalopathy  
• Intracranial hemorrhage  
• Cerebral malformations  
• Chromosomal abnormalities (e.g. Trisomy 21, Prader-Willi syndrome)  
• Congenital infections (TORCH)  
• Drug effects (e.g. benzodiazepines, Magnesium toxicity)  
• Inborn errors of metabolism  
• Endocrine: hypothyroidism  
• Benign congenital hypotonia |
|-------------------------|----------------------------------------------------------|
| Spinal cord             | • Birth trauma (especially Breech delivery)  
• Syringomyelia |
| Anterior Horn Cell      | • Spinal Muscular Atrophy  
• Neurogenic arthrogryposis |
| Neuromuscular junction  | • Myasthenia gravis (transient/congenital)  
• Infantile botulism |
| Peripheral nerves       | • Congenital hypomyelinating neuropathy  
• Hereditary motor and sensory neuropathies (Dejerine-Sottas disease)  
• Hereditary sensory and autonomic neuropathy  
• Guillain Barre syndrome (very rare) |
| Muscle                  | • Congenital myopathies (e.g. central core disease, Nemaline Rod myopathy, myotubular myopathy, congenital fiber type disproportion and multicore myopathy) |
The first goal in diagnosing the source of neonatal hypotonia is to ascertain if it is central (upper motor neuron) or peripheral (lower motor neuron). Central causes are the most common. This delineation will determine the investigations most likely to yield a diagnosis.

**History**

- Any significant family history – affected parents or siblings, consanguinity, stillbirths, childhood deaths
- Maternal disease – diabetes, epilepsy, myotonic dystrophy (may not be recognized)
- Pregnancy and delivery history – drug or teratogen exposure
- Decreased fetal movements
- Abnormal presentation
- Polyhydramnios/ oligohydramnios
- Apgar scores
- Resuscitation requirements
- Cord gases
- History since delivery
  - Respiratory effort
  - Ability to feed
  - Level of alertness
  - Level of spontaneous activity
  - Character of cry
**Physical Examination**

A detailed physical examination should be performed, assessing muscle tone, any asymmetry, the infant’s strength, deep tendon reflexes (DTR), and any dysmorphic or unusual features.

<table>
<thead>
<tr>
<th>Central</th>
<th>Anterior Horn Cell</th>
<th>Nerve</th>
<th>Neuromuscular Junction</th>
<th>Muscle</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal strength</td>
<td>proximal&gt;distal weakness</td>
<td>distal&gt;proximal weakness, bulbar weakness</td>
<td>proximal&gt;distal weakness, normal DTRs</td>
<td>decreased DTRs</td>
</tr>
<tr>
<td>normal/ increased DTRs +</td>
<td>decreased/ absent DTRs</td>
<td>decreased/ absent DTRs</td>
<td>normal DTRs</td>
<td>decreased DTRs</td>
</tr>
<tr>
<td>+/-seizures</td>
<td>+fasciculation</td>
<td>+/-fasciculation</td>
<td>no fasciculation</td>
<td></td>
</tr>
<tr>
<td>+/- dysmorphic features</td>
<td>often described as alert</td>
<td></td>
<td></td>
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At times babies with profound central hypotonia may have absent DTR, therefore absent DTR at least in the first few days of life would not rule out a central cause for the hypotonia.

Note that the presence of profound weakness as well as hypotonia suggests a disorder of the lower motor neuron. A sign of this may be a weak cry. Weakness is uncommon in central hypotonia except in the acute stages.

Arthrogryposis (the fixation of joints at birth) may be associated with neonatal hypotonia, more commonly with lower motor neuron unit or multisystem abnormalities.

Additional clues which may direct to a specific diagnosis:

- Hepatosplenomegaly – storage disorders, congenital infections
- Renal cysts, high forehead, wide fontanelles – Zellweger’s syndrome
- Hepatomegaly, retinitis pigmentosa – neonatal adrenoleukodystrophy
- Congenital cataracts, glaucoma – oculocerebrorenal (Lowe) syndrome
- Abnormal odor – metabolic disorders
- Hypo pigmentation, undesceded testes – Prader Willi

Examination of the mother is also important in suspected cases of congenital myotonic dystrophy or myasthenia gravis.
Most studies have found that central causes account for 60-80% of cases and that the diagnosis can usually be made by a careful history and examination. However, there may be a mixed picture. Infants with a peripheral cause for their hypotonia may be at increased risk for problems during labor, delivery and resuscitation and develop hypoxic ischemic encephalopathy.

**Investigations**

Further investigation needs to be guided by history and examination.

- If the infant is hypotonic but has a degree of strength, a central cause is most likely and investigations should be directed toward this.
- If the infant is hypotonic and weak a peripheral cause is possible and an early review by the neurology service is warranted.

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| • Neuroimaging  
  - Ultrasounds scan in the first instance.  
  - MRI may be indicated if a structural abnormality of brain development is suspected and to exclude other abnormalities (for example, evidence of HIE)  
  - EEG: prognostic information as to brain function, useful clinically if seizures suspected  
  - Karyotype and Microarray (if dysmorphic features)  
  - TORCH screen  
  - DNA methylation studies or FISH for Prader-Willi syndrome (if clinically indicated after a genetics review)  
  - Metabolic workup | • Cervical myelopathies are an infrequent cause of hypotonia. The diagnosis is made by history and examination. Diagnostic studies are of limited value.  
• Molecular genetics – CTG repeats, deletions in SMN gene  
• Creatine kinase (levels need to be interpreted with caution in the newborn, as levels tend to be high at birth and increase in the first 24 hours, they also increase with acidosis). If elevated in an early sample, repeat after a few days.  
• Nerve conduction studies and muscle biopsy (Depending on clinical situation, may be delayed until around 6 months of age as neonatal results are difficult to interpret) |

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Suggested readings:


Volpe JJ. Neurology of the newborn. 4th ed. Philadelphia; W.B. saunders;2001