Peripheral Nerve & Muscle Disease

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Peripheral Nerve & Muscle Disease

- Muscular dystrophy
- Myotonia
- Congenital myopathy
- Spinal muscular atrophy
- Friedreich ataxia

- Hereditary motor & sensory neuropathy
- Autonomic neuropathy
- Guillain-Barre syndrome
- Poliomyelitis
Management

- Accurate diagnosis
- Effective treatment
- Genetic counsel
Chief complaint

- Delayed developmental milestones
- Abnormal gait
- Cavus
History

- Birth history: birth weight, Apgar score
- Growth & development
- Family history: positive
- Static or progressive
- Seizure
Physical examination

- Walking, performing simple tasks, run
- Skin: tuberous sclerosis, neurofibromatosis
- Face: SMA, congenital myotonic dystrophy
- Tongue: fasciculation in LMN lesion
- Ophthalmologic examination
- Muscle testing: muscle power, tone and bulk
- Neurological evaluation
Diagnostic Test

- Hematologic study
- EMG
- Nerve conduction study
- Muscle biopsy
- Nerve biopsy
- Other
- Genetic & molecular biology study
Hematologic study

- CPK, SGOT, aldolase
EMG

neuropathy > myopathy

1. Denervation fibrillation

2. High amplitude increased-duration motor unit potential

Low amplitude short duration polyphasic wave
Nerve conduction study

- peripheral neuropathy
- Velocity
  - 45 - 65 m/sec
  - infant: <
Muscle biopsy

- Rectus abdominis, vastus lateralis, gastrocnemius, deltoid, biceps
Nerve biopsy

- Sural nerve
  - Distal location
  - No autonomous zone

Cross section of normal peripheral nerve, with large and medium-sized myelinated fibers

HMSN I: loss of some large myelinated fibers and ongoing degeneration of myelin
Other

- EKG, PFT, MRI, ophthalmologic examination
Genetic & molecular biology study

- dystrophin test, DNA marker
<table>
<thead>
<tr>
<th></th>
<th>Myopathy</th>
<th>Peripheral Neuropathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle atrophy</td>
<td>Proximal, symmetric</td>
<td>Distal, asymmetric</td>
</tr>
<tr>
<td>Bulbar sign</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Fasciculation</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Sensory abnormality</td>
<td>-</td>
<td>+, -</td>
</tr>
<tr>
<td>DTR</td>
<td>decreased</td>
<td>Lost</td>
</tr>
<tr>
<td>EMG, muscle biopsy</td>
<td>myopathy</td>
<td>neuropathy</td>
</tr>
<tr>
<td>NCV</td>
<td>Normal</td>
<td>decreased</td>
</tr>
<tr>
<td>CPK</td>
<td>increased</td>
<td>normal</td>
</tr>
<tr>
<td>Myalgia, muscle contracture, Hypotonia</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
1. MUSCULAR DYSTROPHY

- Non-inflammatory
- Progressive degeneration of skeletal muscle
- Nervous system involvement: ( - )
Classification of Muscular Dystrophy

Sex-linked muscular dystrophy
- Duchenne
- Becker
- Emery-Dreifuss

Autosomal recessive muscular dystrophy
- Limb-Girdle
- Congenital muscular dystrophy
Classification of Muscular Dystrophy

Autosomal dominant muscular dystrophy

Fascioscapulohumeral
Distal
Ocular
Oculopharyngeal
A. Duchenne M. Dystrophy

- Dystrophin: component of cell membrane cytoskeleton, 0.01% of skeletal muscle protein
Duchenne M. Dystrophy

- Most common
- 3-6 years of age
- X-linked recessive (Xp21.2)
- New mutation: 1/3
Duchenne M. Dystrophy

- **Skeletal muscle**: proximal muscle group, pseudohypertrophy, contracture of tendo Achillis & iliotibial band
- **Cardiac muscle**: sinus tachycardia, right ventricular hypertrophy, and heart failure (10%)
- **Brain**: mental retardation, encephalopathy
1. Gower sign

2. Meyeron (sliding through) sign

3. Ober test
Readings shown as times normal and in ranges of possible values seen in specific diseases. Differences in technique cause variability in range of normal values.
Duchenne M. Dystrophy
Duchenne M. Dystrophy

- Genetic diagnosis using polymerase chain reaction (PCR) on blood
- Prenatal diagnosis as early as the 12th week of gestation by chorionic villi biopsy, amniotic fluid
Treatment

- physical therapy
- orthoses
- surgery: contracture, scoliosis
- medication: steroid, azathioprine
- myoblast, precursor implantation
- genetic and psychological counseling
B. Becker M. Dystrophy

- Less severe
- X-linked recessive trait
- Onset: > 7 years of age
- Slow progressive
Becker M. Dystrophy
C. Emery-Dreifuss muscular dystrophy

X-linked recessive trait (Xq28): emerin deficit

Mild muscle weakness in the first 10 years

Tendo Achillis, elbow, & neck extension contractures
Emery-Dreifuss muscular dystrophy

- Early neck extension contractures & cardiomyopathy
- Sudden death due to complete heart block
D. Limb girdle type muscular dystrophy

Autosomal recessive: sarcoglycanopathy (plasma membrane)

Pelvic girdle > shoulder girdle, 10-15 years of age
E. Fascioscapulohumeral dystrophy

Autosomal dominant, 10-20 years of age

Gene defect: FRG1 on 4q35

Face, shoulder girdle, upper arm

Popeye appearance

Tx: scapulocostal fusion
F. Congenital muscular dystrophy

- **Laminin-2** deficit (basal lamina)
- Contracture, hypotonic, pseudohypertrophy, floppy baby
- Fukuyama type: severe cardiomyopathy & brain malformations, mental retardation, seizure
- Non- Fukuyama type: no mental retardation
Congenital muscular dystrophy
2. MYOTONIA

- Inability of skeletal muscle to relax, ion channel anomaly (Cl, Na, Ca)
- Autosomal dominant
- Type
  - Myotonic dystrophy
  - Congenital myotonic dystrophy
  - Myotonia congenita
Myotonic Dystrophy

Percussion myotonic reaction: thumb moves sharply into opposition and adduction on percussion of thenar muscles and returns to initial position slowly.

Dive-bomber sound
3. CONGENITAL MYOPATHY

- Muscle biopsy: abnormal but not dystrophic---congenital myopathy
- Muscle biopsy: fibrosis along with necrotic fibers---congenital muscular dystrophy
- congenital myopathy:
  - central core disease
  - Nemaline (rod body) myopathy
  - centronuclear (myotubular) myopathy
  - congenital fiber-type disproportion
  - metabolic myopathies
A. Central core disease

- Malignant hyperthermia
B. Nemaline (rod body) myopathy
1. SPINAL MUSCULAR ATROPHY

- Pathologic continuation of apoptosis (survivor motor neuron gene defect) - degeneration of anterior horn cell (motor neuron disease)
- Hypotonia – weakness – thin muscle mass – negative DTR (LMN) – congenital contracture (10%)
- Progressive, fasciculation
- Autosomal recessive, chromosome 5q11-q13
Spinal Muscular Atrophy

- Type I
  (acute Werdnig - Hoffman disease): - 6M
- Type II
  (chronic Werdnig - Hoffman disease): 6-24M
- Type III
  (Kugelberg-Welander disease): 2-10Y
Bell shaped thorax, frog-leg & jug-handle U/E
Physical examination

- Developmental milestone delay
- Gait
- Foot deformity
- Muscle testing
Treatment

- contracture
- hip dislocation
- scoliosis
2. FRIEDREICH ATAXIA

- Most common hereditary ataxia, 7 - 15 Y, autosomal recessive
- Neurodegenerative disorder, decreased frataxin in mitochondria (GAA repeat)
FRIEDREICH ATAXIA

- Dorsal root ganglia cell loss: posterior column, spinocerebellar tract, peripheral nerve degeneration
- Ataxia, cardiomyopathy, scoliosis, cavus
- + Babinski sign, areflexia: degeneration of corticospinal tract with involvement of peripheral sensory neurons (UMN + peripheral sensory neuronopathy)
3. HEREDITARY MOTOR & SENSORY NEUROPATHY

- Type I, II, III: pediatric onset
- IV, V, VI, VII: late onset
## Classification of HMSN

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminology</th>
<th>Inheritance</th>
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<tbody>
<tr>
<td>I</td>
<td>Charcot-Marie-Tooth syndrome (hypertrophic form) or Roussy-Levy syndrome (areflexic dystaxia)</td>
<td>Autosomal dominant</td>
</tr>
<tr>
<td>II</td>
<td>Charcot-Marie-Tooth (neuronal form)</td>
<td>Autosomal dominant</td>
</tr>
<tr>
<td>III</td>
<td>Dejerine-Sotta disease</td>
<td>Autosomal recessive</td>
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## Classification of HMSN

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<th>Type</th>
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<tr>
<td>IV</td>
<td>Refsum disease</td>
</tr>
<tr>
<td>V</td>
<td>Neuropathy with spastic paraplegia</td>
</tr>
<tr>
<td>VI</td>
<td>Optic atrophy with peroneal muscle atrophy</td>
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<tr>
<td>VII</td>
<td>Retinitis pigmentosa with distal muscle weakness and atrophy</td>
</tr>
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</table>
A. HMSN type I

- Charcot-Marie-Tooth disease, hypertrophic form
- **Autosomal dominant**, abnormal gene: 17p11.2 locus – peripheral myelin protein P22
- X-linked abnormal gene: Xq13.1 locus – connexin 32
- **Demyelinating disorder**
  - sensory involvement: large myelinated nerve fibers (proprioception & vibration)
  - autonomic involvement: pallor, cold feet
HMSN type I

- 5 – 15 Y, clumsy, falling, tripping
- peroneal muscular atrophy, **stork-like leg**, ankle dorsiflexor weakness, foot drop
- **pes cavus**: plantar flexed 1st metatarsal --- tripod effect --- hindfoot varus, forefoot supination: Coleman block test
- claw toes & hand
Diagnosis

- P/E, nerve conduction velocity, muscle biopsy
- sural nerve biopsy (onion bulb: proliferated Schwann cell cytoplasm),
Roussy-Levy syndrome
(areflexic dystaxia)

- HMSN type I
- + static tremor in the hand
Treatment

- stabilization of the ankle
- plantar release, tibialis posterior tendon transfer, calcaneal osteotomy, mid tarsal osteotomy, triple arthrodesis
- claw toes
- hip dysplasia
- scoliosis
B. HMSN type II

- Charcot-Marie-Tooth disease, neuronal type
- Autosomal dominant, abnormal gene: KIF1B (1p35-p36)
- Slow progression & less disability
- sural nerve biopsy: axonal degeneration
C. HMSN type III

Dejerine–Sottas disease
Similar to type I but more severe
Kyphoscoliosis
Argyll-Robertson pupil
4. AUTONOMIC NEUROPATHY

- Familial autonomia (Riley-Day syndrome)
- Congenital insensitivity to pain & anhidrosis
- Reflex sympathetic dystrophy
A. Familial autonomia (Riley-Day syndrome)

- decreased number of small unmyelinated nerve fibers
- common in Eastern European Jews
- poor sucking & swallowing, excessive sweating & erythema
B. Congenital insensitivity to pain & anhidrosis

- Boys > girls
- High fever, frequent burns & traumatic injuries
- Total absence of unmyelinated nerve fibers: pain, temperature & autonomic function
C. Reflex sympathetic dystrophy

- Burning pain & hyperesthesia with vasomotor instability
- Increased skin temperature, erythema, edema, hyperhidrosis
5. GUILLAIN-BARRE SYNDROME

- Nonspecific post-viral infection polyneuropathy, 4-9 Y, motor > sensory, autonomic
- Demyelinating > axonal
- Ascending paralysis
- Pain & tenderness in muscle, weakness, refuse to walk, respiratory insufficiency (50%)
6. POLIOMYELITIS

- Release of soft tissue contracture
- Tendon transfers
- Osteotomies
- Arthrodeses
Scoliosis

- Scoliosis: 1/3 by the extent of paralysis of the trunk muscle & pelvic obliquity
- Double major T and L curve
- Orthoses: 20°-40°
- Surgery: Posterior spinal fusion with segmental instrument: <60°
  
  Anterior and posterior spinal fusion: 60° - 100°
Postpoliomyelitis Syndrome

- Dx. of exclusion
- Overuse syndrome: fatigue, muscle & joint pain, new muscle weakness, functional loss, cold intolerance, new atrophy
- Tx: conservative treatment
Thank You