Diseases of the muscles

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Symptoms of muscle disease may include weakness or spasticity/rigidity, myoclonus (twitching, spasming) and myalgia (muscle pain).

Diagnostic procedures that may reveal muscular disorders include testing creatine kinase levels in the blood and electromyography (measuring electrical activity in muscles). MRI
**Inflammatory muscle disorders**

- Polymyalgia rheumatica (or "muscle rheumatism") is an inflammatory condition that mainly occurs in the elderly; it is associated with giant-cell arteritis. It often responds dramatically to glucocorticoids (e.g. prednisolone).
- Polymyositis, dermatomyositis and inclusion body myositis are autoimmune conditions in which the muscle is affected.
- Rhabdomyolysis is the breakdown of muscular tissue due to any cause. While it may not lead to any muscular symptoms at all, the myoglobin thus released may cause acute renal failure.
Fibromyalgia is a common condition that causes pain in muscles, joints, ligaments and tendons. People with fibromyalgia often feel tired and stiff. They may also have trouble sleeping and may feel depressed. The symptoms of fibromyalgia are a little different in every person who has it. Cause of fibromyalgia is unknown.
Significant sudden or more moderate chronic stress (such as having and caring for a new baby) or recurrent poor sleep may cause fibromyalgia in people who are more sensitive to pain. Characteristic alterations in the pattern of sleep and changes in neuroendocrine transmitters such as serotonin, substance P, growth hormone and cortisol suggest that imbalance of the autonomic and neuroendocrine system may be at the root. Many people have had physical and psychologic trauma before the onset. This is particularly true of the relationship between the neuroendocrine axis and sleep. The sleep electroencephalogram shows disturbance of the non-REM sleep phase by intrusions of alpha waves with little deep (stage 3 and stage 4 sleep). People report awakening repeatedly and being “unrefreshed by sleep.” Each of the stages of sleep have special hormone release activity. For example, release of growth hormone occurs primarily during stage 3 and stage 4 of non-REM sleep. One third have low insulin growth factor (IGF) levels, an indication of low growth hormone secretion. Symptoms of fibromyalgia may be created by disturbing non-REM sleep.
**American College of Rheumatology Criteria for Classification of Fibromyalgia**

*Widespread pain for at least three months, defined as the presence of all of the following:*

- Pain on the right and left sides of the body.
- Pain above and below the waist (including shoulder and buttock pain).
- Pain in the axial skeleton (cervical, thoracic or lumbar spine, or anterior chest).

*Pain on palpation with a 4-kg force in 11 of the following 18 sites (nine bilateral sites, for a total of 18 sites):*

- Occiput: at the insertions of one or more of the following muscles trapezius, sternocleidomastoid, splenius capitus, semispinalis capitus.
- Low cervical: at the anterior aspect of the interspaces between the transverse processes of C5-C7.
- Trapezius: at the midpoint of the upper border.
- Supraspinatus: above the scapular spine near the medial border.
- Second rib: just lateral to the second costochondral junctions.
- Lateral epicondyle: 2 cm distal to the lateral epicondyle.
- Gluteal: at the upper outer quadrant of the buttocks at the anterior edge of the gluteus maximus muscle.
- Greater trochanter: posterior to the greater trochanteric prominence.
- Knee: at the medial fat pad proximal to the joint line.
The first measurable effect is an increase in the neural drive stimulating muscle contraction.

Hypertrophy results primarily from the growth of each muscle cell, rather than an increase in the number of cells.
Myasthenia Gravis

- My=muscle, asthen=weakness, gravi=heavy
- Autoimmune disease where antibodies attack the ACh receptors on neuromuscular junctions.
- Results in progressive weakening of the skeletal muscles. Why?
- Treated w/ anticholinesterases such as neostigmine or physostigmine. These decrease the activity of acteylcholinesterase.
Muscular dystrophy – group of inherited muscle-destroying diseases where muscles enlarge due to fat and connective tissue deposits, but muscle fibers atrophy.
Muscular Dystrophy

- Group of inherited muscle-destroying diseases that generally appear during childhood.
- Dys=faulty; Troph=growth
- Most common is Duchenne muscular dystrophy
  - DMD is caused by an abnormal X-linked recessive gene
  - Diseased muscle fibers lack the protein dystrophin which normally links the cytoskeleton to the ECM and stabilizes the sarcolemma
  - Age of onset is btwn 2 and 10. Muscle weakness progresses. Afflicted individuals usually die of respiratory failure, usually by age 25.

Here is a slide of skeletal muscle from someone with DMD. Look how much connective tissue there is. Lots of adipose tissue too. Why do you think there’s so much?
Nine diseases including Duchenne, Becker, limb girdle, congenital facioscapulohumeral, myotonic, oculopharyngeal, distal, and Emery-Dreifuss
Cardiomyopathy:
Dilated; Especially > 15 years
Mental retardation: Mean IQ ~ 88
Night blindness
   Altered response to flashes of light in dark adapted state
   ERG: b-wave,
   Reduced amplitude
Dp260: Isoform of dystrophin in retina
Gastrointestinal: Rare
Type: Pseudo-obstruction; Gastric dilatation
Upper GI tract
Late in disease course
Facioscapulohumeral muscular dystrophy is a muscle wasting condition caused by a genetic fault, which may be affecting the regulation of the level of many of the different proteins in muscles.
Other Important Terms

- **Flaccid paralysis**
  - Weakness or loss of muscle tone typically due to injury or disease of motor neurons

- **Spastic paralysis**
  - Sustained involuntary contraction of muscle(s) with associated loss of function
    - *How do flaccid and spastic paralysis differ?*

- **Spasm**
  - A sudden, involuntary smooth or skeletal muscle twitch. Can be painful. Often caused by chemical imbalances.
Other Important Terms

- **Cramp**
  - A prolonged spasm that causes the muscle to become taut and painful.

- **Hypertrophy**
  - Increase in size of a cell, tissue or an organ.
    - In muscles, hypertrophy of the organ is always due to cellular hypertrophy (increase in cell size) rather than cellular hyperplasia (increase in cell number)
    - Muscle hypertrophy occurs due to the synthesis of more myofibrils and synthesis of larger myofibrils.
Other Important Terms

- **Atrophy**
  - Reduction in size of a cell, tissue, or organ
    - In muscles, it's often caused by disuse. Could a nerve injury result in disuse? Why might astronauts suffer muscle atrophy?

- **Fibrosis**
  - Replacement of normal tissue with heavy fibrous connective tissue (scar tissue). How would fibrosis of skeletal muscles affect muscular strength? How would it affect muscle flexibility?
Atrophy

Fig. 9.2  (A–E) Losses of subcutaneous fat reserves and muscle mass in patients with marasmus.
• Duchenne muscular dystrophy (DMD)
  ◦ Inherited, sex-linked disease carried by females and expressed in males (1/3500)
  ◦ Diagnosed between the ages of 2-10
  ◦ Victims become clumsy and fall frequently as their muscles fail
Muscular Dystrophy

- Progresses from the extremities upward, and victims die of respiratory failure in their 20s
- Caused by a lack of the cytoplasmic protein dystrophin
- There is no cure, but myoblast transfer therapy shows promise
prolonged contraction of skeletal muscle fibers. The primary symptoms are caused by tetanospasmin, a neurotoxin produced by the Gram-positive, obligate anaerobic bacterium *Clostridium tetani*.

Infection generally occurs through wound contamination, and often involves a cut or deep puncture wound. As the infection progresses, muscle spasms in the jaw develop hence the common name, **lockjaw**.

This is followed by difficulty swallowing and general muscle stiffness and spasms in other parts of the body.

Infection can be prevented by proper immunization and by post-exposure prophylaxis.
Clostridium tetani: gram-positive, spore-bearing rods

Organisms enter through large, small, or even unrecognized wounds. Deep, infected punctures are most susceptible, since organisms thrive best anaerobically.

Toxin produced locally passes via bloodstream or along nerves to central nervous system.

Spasm of jaw, facial and neck muscles (trismus [lockjaw], risus sardonicus) and dysphagia are often early symptoms after variable incubation period.

Motor neurons of spinal cord (anterior horn) and of brainstem become hyperactive because toxin specifically attacks inhibitory (Renshaw) cells.

Complete tetanic spasm in advanced disease. Patient rigid in moderate opisthotonos, with arms extended, abdomen boardlike. Respiratory arrest may occur.
ACHALASIA
HIRSCHSPRUNG
Fibrodysplasia ossificans progressiva
MUSCLE BECOME BONE
Muscle sarcomas, such as RMS, and osteosarcomas of bone predominantly affect children. Other sarcomas arise in adults, particularly between the third and fifth decade of life.
**Smooth muscle sarcomas**

Leiomyomas are benign tumors of smooth muscle (or involuntary muscle). Leiomyomas can arise almost anywhere in the body in either men or women because they can start in tissues as widespread, for example, as blood vessels or intestine. The most common of these is the fibroid tumor that develops in many women. It is really a leiomyoma of the uterus.

Leiomyosarcomas are malignant tumors of involuntary muscle tissue. They can grow almost anywhere in the body but are most often found in the retroperitoneum and the internal organs and blood vessels where leiomyomas also arise. Less often, they develop in the deep soft tissues of the legs or arms. They tend to occur in adults, particularly the elderly.

**Skeletal muscle sarcomas**

Rhabdomyomas are benign tumors of skeletal muscle (the muscle that is attached to bone and helps us to move). They are rare.

Rhabdomyosarcomas are malignant tumors of skeletal muscle. These tumors commonly grow in the arms or legs, but they can also begin in the head and neck area and in reproductive and urinary organs such as the vagina or bladder. Children are affected much more often than adults.
Poland syndrome consists of a deficiency of subcutaneous fat and muscles on one side of the body. It may include under development of the arm, hand, and fingers on the same side, and may be associated with other conditions such as Moebius syndrome or Klippel-Feil syndrome. The right side of the body is affected twice as often as the left.

Poland syndrome has several distinctive symptoms:
- Chest muscle deformities - absence of the pectoralis minor and the breastbone part of the pectoralis major
- Under development or absence of breast or nipple on the affected side
- Patchy absence of hair under the arm on the affected side
necrotizing fasciitis