Muscular System

Chapter 16

(pgs 310-324)
Muscular System

- Muscles responsible for all types of body movement
- 3 basic muscle types found in body:
  - Cardiac muscle
  - Smooth muscle
  - Skeletal muscle
Muscle Types

(a) Skeletal muscle
- Nucleus
- Muscle fiber (cell)
- Striations

(b) Cardiac muscle
- Striations
- Intercalated disk
- Nucleus

(c) Smooth muscle
- Nucleus

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Fig. 12-1
Cardiac Muscle

- Only found in heart
- Striated and branched
- Involuntary
- Membranes of adjacent cells fused at *intercalated discs*
Smooth Muscle

- Small and spindle shaped
- Unmarked by any distinctive striations
- aka Visceral
- Involuntary
- Unattached to bones
- Act slowly
- Do not tire easily
- Can remain contracted for long time

- Actions controlled by autonomic nervous system
- Found in wall of internal organs
  - Stomach
  - Intestines
  - Uterus
  - Blood vessels
Sphincter Muscle

• aka Dilator
• Special circular muscles
• Open/close to control passages of substances
• Found:
  – Esophagus-stomach
  – Stomach-small intestine
  – Walls of anus, urethra, mouth
Skeletal Muscle

- Attached to bone of skeleton
- Striped or striated
  - Have cross-bandings of alternating light/dark bands running perpendicular to length of muscle
- aka Voluntary muscle
- Movement to limbs
  - Contract quickly
  - Fatigue easily
  - Lack ability to remain contracted for prolong periods
Properties of Muscle

- **Contractility**
  - Ability to shorten, reducing distance between two parts

- **Excitability**
  - Ability to respond to stimuli

- **Extensibility**
  - Ability to lengthen; increase distance between two parts

- **Elasticity**
  - Ability to return to normal shape
Skeletal Muscle

Function
- Produce movement
- Maintain posture
- Stabilize joints
- Generate heat

Site of muscle attachments
- Bones
- Cartilage
- Connective tissue coverings
Naming Skeletal Muscles

- Direction of muscle fibers
- Location of muscle
- Size
- Number of origins
- Shape
- Location of muscle origin and/or insertion
- Action
Direction of Muscle Fibers

- Relative to midline
- RECTUS = parallel to midline
  - *Rectus Abdominus*
- TRANSVERSE = perpendicular to midline
  - *Transverse Abdominus*
- OBLIQUE = diagonal to midline
  - *External Oblique*
Location

- Structure near which muscle is found
  - FRONTALIS = near *frontal* bone
  - OCCIPITALIS = near *occipital* bone
Relative size of muscle
- MAXIMUS = largest
  - *Gluteus Maximus*
- MEDIUS = middle
- MINIMUS = smallest
  - *Gluteus Minimus*

Size

- LONGUS = longest
  - *Fibrularis Longus*
- BREVIS = short
  - *Fibrularis Brevis*
- TERTIUS = shortest
  - *Fibrularis Tertius*
Number of Origins

- Number of tendons of origin
  - BICEPS = two
    - Biceps Brachii
    - Biceps Femoris
  - TRICEPS = three
    - Triceps Brachii
  - QUADRICEPS = four
    - Quadriceps Femoris
Shape

- Relative shape of the muscle
- DELTOID = triangular shape
- TRAPEZIUS = trapezoid shape
- SERRATUS = saw-toothed
- RHOMBOIDEUS = rhomboid shape
- TERES = round
Origin & Insertion

- **Origin**—attachment to an immoveable bone
- **Insertion**—attachment to a moveable bone
- **ILIO COSTALIS** = attaches to the ilium & ribs (costal = ribs)
- **Belly**—the central part of a muscle
Origin & Insertion

- Biceps Brachii
  - O: coracoid process, supraglenoid tubercle
  - I: radial tuberosity

- Triceps
  - O: infraglenoid tubercle of scapula, posterior humerus
  - I: olecranon process of ulna
**BICEPS BRACHII**

**ORIGIN**
Long head: supraglenoid tubercle of scapula. Short head: coracoid process of scapula with coracobrachialis

**INSERTION**
Posterior border of bicipital tuberosity of radius (over bursa) and bicipital aponeurosis to deep fascia and subcutaneous ulna

**ACTION**
Supinates forearm, flexes elbow, weakly flexes shoulder

**NERVE**
Musculocutaneous nerve (C5, 6) (from lateral cord)

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**TIBIALIS ANTERIOR**

**ORIGIN**
Upper half of lateral shaft of tibia and interosseous membrane

**INSERTION**
Inferomedial aspect of medial cuneiform and base of 1st metatarsal

**ACTION**
Extends and inverts foot at ankle. Holds up medial longitudinal arch of foot

**NERVE**
Deep peroneal nerve (L4, 5)
<table>
<thead>
<tr>
<th>Name</th>
<th>Action</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLEXOR</td>
<td>Decrease angle at a joint</td>
<td>Flexor Carpi Radialis</td>
</tr>
<tr>
<td>EXTENSOR</td>
<td>Increase angle at a joint</td>
<td>Extensor Carpi Ulnaris</td>
</tr>
<tr>
<td>ABDUCTOR</td>
<td>Move bone away from midline</td>
<td>Abductor Pollicis Longus</td>
</tr>
<tr>
<td>ADDUCTOR</td>
<td>Move bone toward midline</td>
<td>Adductor Longus</td>
</tr>
<tr>
<td>LEVATOR</td>
<td>Produce upward movement</td>
<td>Levator Scapulae</td>
</tr>
<tr>
<td>DEPRESSOR</td>
<td>Produce downward movement</td>
<td>Depressor Labii Inferioris</td>
</tr>
<tr>
<td>SUPINATOR</td>
<td>Turn palm upward/anterior</td>
<td>Supinator</td>
</tr>
<tr>
<td>PRONATOR</td>
<td>Turn palm downward/posterior</td>
<td>Pronator Teres</td>
</tr>
</tbody>
</table>
Types of Muscle—Actions

- **Prime mover (agonist)**—muscle with the major responsibility for certain movement
- **Antagonist**—muscle that opposes or reverses a prime mover
- **Synergist**—muscle that aids a prime mover in a movement and helps prevent rotation
- **Fixator**—stabilizes the origin of a prime mover

Muscle Injuries
Acute Muscle Injuries

- Contusions
- Strains
- Tendon Injuries
- Cramps/spasms
- Overexertional problems
Contusion

- Bruise
- Sudden traumatic blow to body (severe compression force)
- Not penetrate skin
- Usually injury to blood vessels
- Superficial, deep, or hemorrhage

- Hematoma (blood tumor): formation caused by pooling of blood and fluid within a tissue space
- Speed of healing depends on tissue damage and internal bleeding
Contusion

- Symptoms:
  - Swelling
  - Point tenderness
  - Redness
  - Ecchymosis
- Treatment: PRICE, stretch
- Complication: myositis ossificans—calcification of the muscle to bone
Strains

- Stretch, tear, or rip in the muscle or adjacent tissue (fascia or muscle tendon)
- Severe tension force
- Common sites:
  - Hamstring
  - Quadriceps
  - Hip flexor
  - Biceps
  - Latissimus dorsi
Strains

• Grade 1
  – Some muscle fibers stretched or torn
  – Some tenderness/pain with AROM

• Grade 2
  – Number of muscle fibers torn
  – Active contraction of muscle extremely painful

• Grade 3
  – Complete rupture of muscle (MTJ)
  – Significant impairment or total loss of movement
Strains

Signs & Symptoms
• Localized swelling
• Cramping
• Inflammation
• Loss of function
• Pain
• General weakness
• Discoloration

Prevention
• Proper warm-up
• Stretch
• Proper mechanics
• Proper cool-down/stretch
• Proper nutrition & hydration
Strains

• Treatment
  – Reduce swelling & pain
  – NSAIDs

• Severe—
  – Hard cast
  – Surgery
Tendon Injuries—
Anatomy of a Tendon

• Extension of muscle
  – Musculotendinous junction
• Contains wavy parallel collagenous fibers
  organized in bundles surrounded by gelatinous material
  that decreases friction
• Connects muscle to bone
  – Concentrates pulling forces in limited area
• Not as elastic
• May run through sheath
**Tendon Injuries**

- Tears commonly at muscle belly, musculotendinous junction, or bony attachment
  - Tendon double strength muscle it serves

- **Tendonitis**: inflammation of tendon-muscle attachments, tendons, or both

- **Tenosynovitis**: inflammation of synovial sheath surrounding tendon
Tendonitis

• Signs & Symptoms
  – Pain & inflammation
  – Worse with movement
  – Worse at night

• Treatment
  – PRICE
  – NSAIDs
  – Ultrasound therapy
  – Rehabilitation

• Prevention
  – Slowly increase intensity & type of exercise
  – Don’t try to do more than ready for
  – Proper warm-up & stretch
Cramps/Spasms

- **Cramp**: painful involuntary contraction of a skeletal muscle or muscle group
- **Spasm**: reflex reaction caused by trauma of musculoskeletal system

→ Can lead to muscle and tendon injuries
Overexertion Muscle Injuries

**Soreness**
- Muscular pain from strenuous muscular exercise
- DOMS
- Preventative
- Treatment

**Stiffness**
- Occurs when muscles worked hard for long period of time
- Fluids that collect in muscle during/after activity absorbed in bloodstream slowly
- Result in swollen, shorter, thicker muscle that resist stretching
Chronic Musculotendinous Injuries

- **Myositis**: inflammation of muscle tissue
- **Fasciitis**: inflammation of muscle fascia
  - Fascia supports and separates muscle
- **Tendinitis**
- **Tenosynovitis**
Chronic Musculotendinous Injuries

Ectopic Calcification
- Myositis ossificans
  - Occur in muscle directly overlies bone

Atrophy
- Wasting away of muscle tissue
  - Immobilization of body part; loss of nerve simulation

Contracture
- Abnormal shortening of muscle tissue
- Resistance to passive stretch
  - Associated with joint developed resisting scar tissue
Critical Thinking

Football player who plays wide receiver sustains repeated blows his to left quadriceps muscle.

1. What should he be most concerned about?

2. What type of injury could be sustained from repeated compressive forces to the quad muscle?