NEUROMUSCULAR

Musculoskeletal System

Review A & P Jarvis pg 598-605

Range of Motion

- Aging Adult
  - Loss of bone matrix (resorption) occurs more rapidly than new growth (deposition).
  - Osteoporosis—females>males>, whites>blacks

- Postural changes—decreased height due to shortening of vertebral column
  - Loss of water content and thinning of intervertebral disks
  - Begins at age 40 in males, age 43 in females
  - Not significant until age 60
  - Greater decrease in 70’s and 80’s due to osteoporotic collapse of vertebrae
  - Kyphosis, backward tilt to head, slight flexion of hips and knees
  - Gain weight in 40’s and 50’s, lose fat in face and deposit in abdomen and hips.
  - In 80’s, decrease in fat in periphery, especially noticeable in forearms.
  - Bony prominences more marked.

Subjective Exam

- Joints
  - Joint pain and loss of function most common musculoskeletal concern that prompts a person to seek care.
  - Rheumatoid arthritis (RA)—symmetric joints.
  - Other problems involve isolated or unilateral joint.
  - RA pain is worse in the morning and after rest, pain decreases with movement. Keep active.
  - Osteoarthritis is worse later in the day, movement increases joint pain.
  - Tendonitis—is worse in the morning, pain lessens during the day.

- Muscles
  - Cramping versus aching
  - Intermittent claudication—calf pain which occurs with walking, and goes away with rest, vascular.
  - Viral illness can include myalgia “aches all over”
  - Weakness
  - Atrophy

- Bones
  - Fractures cause sharp pain that increase with movement.
  - Other bone pain dull and deep
  - Deformity, accident, trauma?

- Functional assessment (ADL’s)
  - Do joint problems place limits on ADL’s?
  - Functional assessment—breaks down to very specific activities.
- Self-care behaviors
  - Heaving lifting at work?
  - Repetitive motions?
  - Weight gains or change of diet?
  - What medications are being taken?

- Aging
  - Use of mobility aids—canes, walkers.

**Order of Exam**

**Inspection**—
- Size, contour of joint.
- Skin and tissue—color, swelling, masses, or deformities
- Swelling due to excess joint fluid (effusion), thickening of synovial lining, inflammation of surrounding soft tissue (bursae, tendons) or bony enlargement
- Deformities due to dislocation, subluxation (partial dislocation), contracture (shortening of muscle), ankylosis (stiffness or fixation).

**Palpation**—
- Heat, tenderness, swelling, masses.
- Synovial membrane thickened—feels doughy or boggy.
- Palpable fluid abnormal—enclosed in sac, if push on one side—it bulges on the other side.

**Range of motion**
- Assess active ROM.
- If unable—perform passive goniometer which measures angles.
- Crepitation—audible and palpable crunching or grating with movement occurs when articular surfaces in joints roughened (RA).

**Muscle Testing**—
- Test strength for prime mover muscle groups for each joint
- See “Grading Muscle Strength” pg. 612

- Temporomandibular joint
  - Depressed area just anterior to ear.
  - Audible or palpable snap or click when mouth is opened.

- Cervical Spine
  - Check range of motion
  - Flexion, hyperextension, lateral, bending, rotation.

- Shoulder
  - Look for asymmetry
  - Dislocated—looks flattened; if excess fluid present, must be in large amounts in order to observe.
  - ROM—rotator cuff shows muscle spasm during abduction. Forward flexion normal.
- **Elbow**
  - Subluxation—forearm dislocated posteriorly.
  - Effusion or synovial thickening—bulge or fullness in groove on either side of olecranon process—gouty arthritis.
  - Epicondyles, head of radius, tendons inflamed and local tenderness—tennis elbow.
  - Subcutaneous nodules in olecranon.
  - Bursa and along extensor surface of ulna—RA

- **Wrist and hand**
  - Ulnar deviation—fingers drift to ulnar side (RA)
  - Ankyloses—extreme flexion of wrist—RA
  - Dupuytren’s contracture—flexion contracture of fingers, 4th digit, then 5th, then 3rd, occurs in men past 40, history of diabetes, epilepsy, alcoholic liver disease, and inherited trait.
  - Swan-neck or boutonniere—in chronic RA, may be with ulnar deviation.
  - Atrophy of thenar eminence—goes with carpal tunnel, chronic repetitive motions, ages 30 to 60, more common in women than men.
  - Ganglion cyst—round, cystic, nontender nodule, usually on dorsum of wrist.
  - Phalen’s test—checks for carpal tunnel hand’s back to back flexed at wrist at 90 degree angle hold for 60 seconds.
  - If numbness and burning it is positive.
  - Tinel’s sign—direct percussion on median nerve, numbness and tingling positive for carpal tunnel.

- **Hips**
  - In supine position—bend one knee up to chest, opposite leg remains flat.
  - If flat leg doesn’t remain on table, positive Thomas test.
  - Limited abduction of hip in supine position.
  - Most common motion dysfunction in hip disease.

- **Knee**
  - Angulation deformity
    - Genu varum—bow legs.
    - Genu valgum—knock knees
  - Flexion contracture
  - Fullness or swelling, especially prepaltellar.
    - Bursa and suprapatellar or pouch.
  - Bulge sign—fluid wave occurs with a little as 4 to 8 mL fluid.
  - Ballottement of patella—checking for larger amounts of fluid.
  - Some crepitus normal with no other symptoms.
  - Severe crepitus—degenerative diseases.
  - McMurray’s Test—meniscal tears—Hear or feel click—positive.

- **Ankle and Foot**
  - Compare symmetry.
  - Check ROM and strength.
- Spine
  - Look for scoliosis—difference in shoulder elevation, level of scapulae, and iliac crests.
  - Herniated nucleus pulposus—tilts laterally and bends forward.
  - ROM
    - Straight leg raising or La Segue’s Test.
      - Help confirm herniated nucleus pulposus.
      - Test positive if produces sciatic pain.
  - Leg length discrepancy
    - Unequal—pelvic obliquity or adduction, or flexion deformity of hip.

Abnormal findings—Jarvis pg 643-653
NEURLOGIC SYSTEM, PAIN & SENSORY NERVES

Central Nervous System
Includes brain and spinal cord

- Cerebral cortex—center for highest functions, governing thought, memory, reasoning, sensation, and voluntary movement.
  - Hemispheres (two)—left dominant in 95% people
  - Frontal lobe—personality, behavior, emotions, and intellectual functions.
  - Precentral gyrus—initiates voluntary movement.
  - Parietal lobe—sensation
  - Occipital lobe—visual
  - Temporal lobe—auditory
  - Wernicke’s area—in temporal lobe, language comprehension, damage results in receptive aphasia (hears sound but has no meaning)
  - Broca’s area—in frontal lobe, motor speech, damage results in expressive aphasia (cannot talk).

- Basal ganglia—form extrapyramidal system, automatic associated movements (arm swing alternating with legs during walking).

- Thalamus—main relay station for nervous system

- Hypothalamus—temperature, heart rate, blood pressure control, sleep center, anterior and posterior pituitary glands regulator, coordinator of ANS and emotional status.

- Cerebellum
  - Motor coordination of voluntary movements—doesn’t initiate movement but coordinates and smooths it.

- Brainstem—central core of brain
  - Midbrain—contains many motor neurons and tracts
  - Pons—contains ascending and descending fiber tracts
  - Medulla—vital autonomic centers (respiration, heart, GI functions).

- Spinal cord—main highway for ascending and descending fiber tracts that connect brain to spinal nerves and mediates reflexes.

Pathways of CNS

- Crossed representation—left cerebral cortex interacts with right side of body, right cerebral cortex interacts with left side of body.

- Sensory pathways
  - Sensor receptors monitor conscious sensation, internal organ functions, body position, and reflexes.
Sensation travels in afferent fibers in peripheral nerve, then through posterior (dorsal) root into spinal cord.

Two routes—spinothalamic tract or posterior (dorsal) column.

Spinothalamic tract—
  Pain and temperature sensations ascend laterally, crude touch ascends anterior tract.

Posterior (dorsal) column
  Position—proprioception
  Vibration
  Finally localized touch—stereognosis
  Sensory cortex arranged to form brain
  Map—organs such as heart, liver, and spleen absent from map so pain originating from these organs is referred (heart referred to chest, shoulder, and left arm).

Motor pathways
  Corticospinal or pyramidal
    Mediate voluntary movement, particularly very skilled, discrete, purposeful movements.
    Never, “higher” system
  Extrapyramidal tract
    “Lower”, more primitive
    Maintain muscle tone and control body movements, especially gross automatic movements.
  Cerebella system
    Coordinates movement, maintains equilibrium, helps maintain posture.

Upper and Lower Motor Neurons
  Upper—located with CNS
    Corticospinal, corticobulbar, and extrapyramidal tracts.

  Lower—located mostly in peripheral nervous system
    Cranial nerves and spinal nerves of peripheral nervous system.
    Lower neuron diseases—spinal cord lesions, poliomyelitis, amyotrophic lateral sclerosis (ALS).

Peripheral Nervous System
  Nerve—bundle outside CNS
    Input to CNS via afferent fibers.
    Output from CNS via efferent fibers.

  Reflex Arc—involuntary, operative below level of conscious control, permit quick reaction to potentially painful or damaging situations.
    Deep tender reflexes (myotactic)—patellar or knee jerk
    Superficial—corneal reflex, abdominal reflex.
    Visceral (organic)—pupillary response to light and accommodation.
    Pathologic (abnormal)—Babinski’s or extensor plantar reflex.

  Cranial Nerves
    12 pair—primarily head and neck
    Vagus—travels to heart, respiratory, muscles, stomach, and gallbladder
- **Spinal Nerves**
  - 8 cervical
  - 12 thoracic
  - 5 lumbar
  - 5 sacral
  - 1 coccygeal
  - dermatome—circumscribed skin area supplied mainly from one spinal cord segment through a particular spinal nerve.

- **Autonomic Nervous System**—mediates unconscious activity.
  - Functional division of peripheral nervous system
  - Somatic fibers innervate skeletal (voluntary) muscles
  - Autonomic fibers innervate smooth (involuntary) muscles, cardiac muscle, glands.

- **Aging Adult**
  - General atrophy and steady loss of neurons in brain and spinal cord.
  - Over age 65
    - General loss of muscle bulk.
    - Loss of muscle tone in face, neck, around spine, decreased muscle strength, impaired fine coordination and agility, loss of vibratory sense at ankle, decreased or absent Achilles reflex, loss of position sense at big-toe, pupillary miosis, irregular pupil shape, decreased pupillary reflexes.
    - Reaction time slower
    - Touch and pain sensation, taste, and smell may be diminished
    - Muscle strength and agility decreased
    - Muscle tremors may occur in hands, head, jaw, possible repetitive facial grimacing (dyskinesias).
    - Decreased blood flow and O₂ consumption dizziness, loss of balance with position change.

**Subjective Data**
1. Headache
2. Head injury – loss of consciousness, how long?
3. Dizziness (vertigo)
   - Syncope—sudden loss of strength, temporary loss of consciousness due to lack of cerebral blood flow (faint)
   - Vertigo—rotational spinning caused by neurologic dysfunction or problem in vestibular apparatus or vestibular.
   - Nuclei in brain stem
     - Objective—room spins
     - Subjective—client spins
4. Seizures—occur with epilepsy, paroxysmal disease characterized by altered or loss of consciousness, involuntary muscle movements, and sensory disturbances.
   - Aura—subjective sensation that precedes seizure, can be auditory, visual, or motor. Examples: headache, double vision, nausea, jittery, smells, last 5 to 10 seconds.
5. Tremors.
6. Weakness (paresis)
7. Incoordination
   - dysmatria—inability to control range of motion of muscles.
8. Numbness or tingling
   - paresthesia—abnormal sensation, burning, tingling.
9. Difficulty swallowing
10. Difficulty speaking
11. Significant past history—CVA (stroke), spinal cord injury, meningitis or encephalitis, congenital defect or alcoholism.
12. Environmental/occupational hazards
   - Aging—senile tremors—relieved by alcohol.

**Objective Exam**

Cranial Nerves

I. Olfactory—check patency of each nostril occlude and check smell in each nostril.
   - Anosmia—decreased or loss of smell occurs bilaterally with tobacco smoking, allergic rhinitis, and cocaine use.
   - Unilateral—neurogenic anosmia

II. Optic—check visual acuity and visual fields.
   - Visual field loss—pg 330
   - Papilledema (edema and inflammation of optic nerve at it’s point of entry into eyeball)

III, IV, VI. Oculomotor, Trochlear, Abducens
   - Ptosis (drooping of eyelids) occur with myasthenia gravis, dysfunction of cranial nerve 3, or Horner’s syndrome.
   - Strabismus—deviated gaze (crossed eyes)
   - Nystagmus—involuntary eye movements.

V. Trigeminal
   - Strength should be symmetrical
   - Asymmetry in jaw movement
   - Pain with clenching teeth
   - Sensory function—decreased or unequal.
   - Corneal reflex—no blink can indicate lesion of cranial nerve V or cranial nerve VII paralysis.

VII. Facial
   - Look for muscle weakness, drooping, lower eyelid sagging, escape of air from only one cheek that is pressed in due to central nervous system lesions (brain attack or stroke), and peripheral nervous system lesion (Bell’s Palsy)

VIII. Acoustic (vestibulocochlear)
   - Whispered voice test, Weber and Rinne

IX, X Glossopharyngeal and Vagus
   - Look for absence or asymmetry of soft plate movement, uvula deviates to side or asymmetry of tonsillar pillar movement.
Hoarse or brassy voice occurs with vocal cord dysfunction nasal twang occurs with weakness of soft palate.

XI. Spinal Accessory
- Examine appearance and strength of sternomastoid and trapezius muscle.

XII. Hypoglossal
- Tongue should thrust forward at midline with no tremors.

**MOTOR SYSTEM**

- **Inspect and Palpate**
  - **Muscles**
    - Size—compare symmetry
    - Atrophy due to disuse, injury, lower motor.
    - Neuron disease such as polio, diabetic neuropathy
    - Hypertrophy—isometric exercise
  - **Strength**
    - Tone—normal degree of tension
    - Examine ROM, any pain?
    - Flaccidity—decreased resistance, hypotonic
    - Spasticity and rigidity
    - Involuntary movements—tic, tremor, fasciculation (involuntary twitching), myoclonus (twitching of a group of muscles), chorea (involuntary muscle twitching of face or limbs), athetosis (involuntary snakelike movements).

- **Cerebellar Function**
  - **Balance**
    - Gait—observe client walking and heel-to-toe
      - Look for stiff, immobile posture, staggering, or reeling, unequal rhythm.
      - Lack of arm swing or rigid arms
      - Ataxia—uncoordinated or unsteady gait.
    - Romberg test—wait 20 seconds and stand close to client and ready to catch.
      - Positive—cerebellar ataxia (M.S., alcohol, intoxication, loss of proprioception, and loss of vestibular functions)

- **Coordination and skills Movements**
  - **Rapid Alternating Movements**
    - Look for lack of coordination
    - Dysdiadocho kinesia—slow, clumsy, sloppy response.
    - Finger to finger—dysmetria (clumsy movement with overshooting mark), past-pointing (constant deviation to one side)
    - Finger to nose
    - Heel to shin
SENSORY SYSTEM

- Person must be alert and cooperative for tests to be valid.
- Only do complete testing when initial results abnormal
- Compare symmetry
- Proceed from decreased sensation toward sensitive area.

- Spinathalamic Tract
  Pain—dull versus sharp using broken tongue blade (dispose with each client)
  - Allow at least 2 seconds, between applications to avoid summation.
  - Hypalgesia—decreased pain sensation
  - Analgesia—absent pain sensation
  - Hyperalgesia—increased pain sensation

  Temperature—only if pain sensation abnormal
  - Test tubes with hot and cold
  - Light touch—touch with cotton ball at irregular intervals
  - Client should respond yes or no
  - Hypoesthesia—decreased touch, anesthesia—no sensation, hyperesthesia—increased touch sensation.

- Posterior Column Tract
  1. Vibration—low pitched tuning fork (128-256 Hz)
     - Place over bony surface
     - Determine when vibration starts and stops
     - Move from distal to proximal
     - Loss can occur with peripheral neuropathy (diabetes)
  2. Position—hold by sides so doesn’t give clues to position
  3. Tactile discrimination (fine touch)—abnormal may indicate lesion of sensory cortex or posterior column.
  4. Stereognosis—recognize objects by feel.
     - Astereognosis—inability
  5. Graphesthesi—reading numbers traced on palm—inability with lesions of sensory cortex.
  6. Two point discrimination—ability to distinguish separation of two simultaneous pin points.
  7. Extinction—touch both side of body simultaneously at same point. If only recognize one side, stimulus extinguished (not felt) on side opposite cortex lesion.
  8. Point location—can client touch area of previous stimulus.
**Reflexes**

Use pointed end of hammer for examiner

**Thumb**

**Scale**

- 4+ very brisk, hyperactive with clonus, indicative of disease
- 3+ brisker than average, may indicate disease
- 2+ average, normal
- 1+ diminished, low normal
- 0 absent

Clonus— short, jerking contractures of muscle

Hyperreflexia— occurs with upper motor neuron dysfunction, e.g. CVA

Hyporeflexia— occurs with lower motor neuron dysfunction, e.g. spinal cord injury

- **Reinforcement**—relaxes muscles and chances response
  - Lock fingers together and pull (patellar)
  - Clench teeth (biceps)
  - Grasp thigh with opposite hand (biceps)

**Biceps**—

**Triceps**—

**Brachioradialis**—

**Quadriceps (knee jerk)**

**Achilles**

**Clonus** -

**Abdominal**

**Plantar**

- **The Aging Adult**
  - Taste and smell diminished
  - Decreased muscle bulk—especially seen in hands
  - Senile tremors—hands, head nodding, tongue
    - Protrusion normal
    - Dyskinesias—repetitive stereo typed movements in jaw, lips or tongue may be present—no rigidity
  - Distinguished senile tremors for parkinsonism which includes rigidity, slowness, and weakness of voluntary movement
  - Gait slower and more deliberate
  - Rapid alternation movement
  - Decreased sensation of vibration at ankle malleolus
  - Position senses lost in big toe
  - Tactile sensation impaired—light touch and pain
Reflexes less brisk

- Neuro check—abbreviated exam
  1. Level of consciousness
     - Change
     - Ease of arousal
     - Orientation—person, place, time
     - If not fully alert, increased stimulus in following order
       a. Name called
       b. light touch on person’s arm
       c. vigorous shake of shoulder
       d. pain applied (pinch nail bed, pinch trapezius muscle, scrub knuckles on sternum)
  2. Motor function
     Lift eyebrows, frown etc
     Hand grasp
     Lower extremities also
  3. Pupillary response—size, shape, symmetry
     Direct and consensual light reflex
     Pupil size in millimeter
  4. Vital signs—changes late consequence of rising ICP
     Cushing reflex—ICP, blood pressure elevates with widening pulse pressure, pulse rate decreases, slow, bounding

Review Abnormal Findings Jarvis pg. 701-709