Orthopedic and Neurologic Evaluation

**Clinical Impression** - The intent of the clinical impression is to establish the appropriateness of rendering chiropractic care or determining the possible need for consultation prior to or concurrent with chiropractic care.

**Framework of Clinical Impression**
- Nature of onset
- Mechanism of injury
- Time frame of condition, i.e., acute/subacute/chronic
- Region of involvement and severity of dysfunction
- The manifestations of neuromuscular dysfunction, i.e., segmental dysfunction
- Vertebral subluxation complex
- Attendant and/or concurrent somatic and/or organic dysfunction
- Unrelated conditions affecting working clinical impressions

**Why Diagnostic Procedures Are Necessary**
- Fulfill criteria of clinical impression
- Identifying disease outside of biomechanical dysfunction
- Establishing interdisciplinary dialogue relating to condition
- Formulate treatment options
- Prognosticate outcomes
- Differentiation, i.e., comparing and contrasting clinical findings
- Satisfying requirements of third party payers

**Chiropractic Analysis** - Unique and distinct from diagnosis, the commonality in its use is based on the concept of structure, primarily the spine, and how spinal dysfunction or disease affects function.
- To direct conservative protocol
- Affects technique
- Fulfills the unique and distinct approach attributed to chiropractic care, i.e., chiropractic as an alternate therapeutic approach from orthodox medicine

**Physical Examination**

Preliminary Examination
- Inspection
- History
- Vital signs
- Prescreening
Routine Assessment
- Inspection
- Palpation
- Percussion
- Auscultation

Chiropractic Analysis

Orthopedic Testing

Neurologic Testing

Other Considerations, i.e., radiographic, instrumental, laboratory

**Inspection**

Observe the patient upon entry into your office and assess the general status. Note speech, body movements, gait, habitus, etc.

**History**

The history is an essential aspect to your diagnostic evaluation of a patient as it directs your working diagnosis and therefore your exam. The effective taking of a case history involves appropriate interrogatives pertinent to the presenting complaint and interpretation of the responses. Approximately 90% of your diagnosis will come from the history.

The history consists of:
- Identification of the patient’s chief complaint
- Present Illness
- Past History
- Review of Systems
- Family History
- Personal Social History
- Patient Profile

**Chief Complaint**

Establishes the patient’s reason for seeking care.

O - Onset
P - Provocation of pain or palliation of pain
Q - Quality of pain
R - Referred or radiation of pain
S - Site of pain
T - Timing of pain
Present Illness

Obtaining the specific details of the Chief Complaint.

Past History

- Investigates the patient’s previous health, illnesses, accident(s) and operation(s).
- The patient gives YES or NO answers to specific questions concerning the skin, nervous system, eyes, ears, nose, mouth, throat, breast, respiratory, cardiovascular, gastrointestinal, genitourinary, obstetrical, musculoskeletal, neuropsychiatric, lymphatic, and endocrine systems.

Review of Systems

Requests information of specific systems to detect relevant illnesses or tendencies to the chief complaint not covered in the Past History.

Family History

Helps to detect any familial or genetic tendencies, or exposure to communicable conditions.

Personal/Social History

Gives the examiner a perspective of the patient’s social interactions.

Patient Profile

The examiner gives a general summary of the patient considering the information brought forth from the interview.

Vital Signs

Temperature — oral 37º Celsius; Axillary 36º Celsius; Rectal 38º Celsius

Pulse Rate — 72 BPM; Decrease = syncope or obstruction; Increase = fever or exercise

Respiratory Rate — 14 - 18 breaths per minute. Fever increases respiratory rate. For example, a 1º increase in fever leads to an increase of 4 breaths per minute.

Blood Pressure — A blood pressure of 160/95 is considered pathological according to the World Health Organization

Height/Weight/Age

A routine examination involves assessment of all regions of the body. In a particular case however, the physical examination will involve a more detailed examination of the organs and systems relevant to the
working diagnosis. In any case, the process of the examination requires the development of a consistent and logical sequence of procedures. As a guideline for most of the body, examination procedures will include the following elements;

- Inspection
- Palpation
- Percussion
- Auscultation
- Each element may be more or less pertinent in some areas and situations and include additional more detailed procedures.

**ASPECTS OF PHYSICAL EXAM FOR HEAD AND CERVICAL SPINE**

**HEAD**

- Inspection, i.e., bleeding, bruising, abrasions, contusions, ecchymosis, and head tilt
- Assess cranial nerves
- Rule out concussion (neurological consideration)
- ROM of jaw, i.e., palpation to swelling and tenderness
- Instrumentation if necessary (oto-ophthalmoscopic, etc.)

**EYES**

**Inspection**

- Inspect the eyelids, eyebrows, conjunctivae (clear), sclera (white), lacrimal apparatus. Inspect for nystagmus, strabismus, and ptosis. Confrontation test for visual fields. Snellen chart for visual acuity.

**Palpation**

- Ocular orbits, eyeball for ocular tension, lacrimal gland and duct.

**Instrumentation** — Funduscopic examination is primarily concerned with checking the optic disc, blood vessels, and retina.

- Margin of the disc — should be clear and defined. A blurred disc = papilledema due to intracranial pressure
- Color of the disc — pinkish white. A chalky white color = optic atrophy
- Size of the optic cup — 1:3 ratio of the cup to the disc
- Shape of the optic cup — a bulging cup = papilledema. An increase in cupping = glaucoma
- Examine the vessels of the retina. Arterioles are thinner and lighter than veins. The arterioles demonstrate a light reflex from their walls, which may be thickened in chronic hypertension, or the copper or silver wire sign. Also note any narrowing, tortuosities, (“cotton wool”) exudates, or (“flame-like”) hemorrhages.
• Note any pigmentation or deposits in the retina itself, and the fovea centralis, located 2 disc diameters temporally from the disc and the macula. The macula should be cherry red.

**Spots on the Retinal Field**

- Cotton Wool exudates = hypertension
- Waxy exudates = Diabetes Mellitus or chronic hypertension
- Flame hemorrhages = hypertension
- Deep hemorrhages = chronic hypertension
- Drusen bodies (white spots on the retinal field) are normal in geriatric patients
- Microaneurysms (Punctate Petechiae) = Diabetes Mellitus

**Examination of the External Eye** —Check alignment and look for deviation and gaze

- Eyebrows—loss of the lateral = myxedema
- Lids—cranial nerve III opens the eyes, cranial nerve IV closes the eyes
- Lacrimal apparatus—for blockages and inflammation
- Conjunctiva—for change in color and inflammation
- Sclera—for change in color. Blue— Osteogenesis Imperfecta
- Cornea and Iris — for abnormalities in size and shape
- Pupils— PERRLA (pupils should be equal, round, react to light and accommodate)

**EARS**

**Inspection**

Inspect the pinna (lobe) and canals for any masses, lesions, discolorations, discharges. Look for any growth or obstructions of the canal.

**Palpation**

Palpate for any nodules or masses, or tenderness. Pain elicited upon pulling = Otis externa in adults

**Instrumentation**

- Select the largest speculum which will fit into the canal. Note any growths or discolorations of the canal.
- The tympanic membrane should be pearly-grey, demonstrate the light reflex, and show no evidence of perforation (which appears as darkened areas on the ear drum). Abnormal discoloration of the ear drum suggests pathology.
- “Angry Red” — Otitis Media
- “White” — Pus
- “Pink”— Myringitis (inflammation of the ear drum)
- “Blue” — Hemorrhage
- A bulging ear drum suggests acute middle ear infection. Remember, the patient should be able to hear a ticking watch bilaterally.
Rinne’s Test
- Air conduction (AC) is two times greater than bone conduction (BC).
- Hold the stem of a vibrating tuning fork (512 Hz) on the mastoid of the patient. When they state they are unable to hear the sound (by bone conduction) immediately move the tuning fork near the external auditory meatus (EAM) and have the patient state when they can no longer hear the sound (by air conduction). Normally, the patient should be able to hear the tuning fork twice as long as air conduction than bone conduction. This is a Rinne positive which is considered normal.
- Rinne Negative (R-) — occurs when sound is heard longer on the mastoid. BC < AC
- Rinne Equal (R=) — BC = AC
- Rinne Equal and Rinne Negative suggest the presence of an obstruction such as ear wax
- Rinne Diminished — comparison of one ear to the other, suggests sensory nerve loss

Weber’s (Lateralization) Test
- This test is performed on a patient demonstrating a UNILATERAL hearing deficiency. Place a vibrating tuning fork on the midline of the patient’s head (the forehead, or vertex). In a normal patient, the sound is perceived equally in each ear.
- In nerve deafness, there will be lateralization to the good ear.
- In air conduction loss (as with blockage of the EAM), sound is heard better in the bad ear.

NOSE - SINUSES - MOUTH - PHARYNX

Inspection
Check the skin for abnormalities, nasal passages for growth or obstructions and discharge, nasal septum for perforations and deviation. Mucosa and gums should be pink and the tongue and uvula should be midline.

Palpation
For masses and tenderness

Instrumentation
Use a nasal specula to inspect for abnormalities

CERVICAL SPINE
- Inspection, palpation, percussion and range of motion
- Specialty testing, i.e., orthopedic, neurologic, neurovascular, biomechanical

Orthopedics — Orthopedic tests are effective tools to making a diagnostic evaluation of the patient who presents with pain. The purpose of an orthopedic test is to introduce a forceful movement which is designed to reproduce the pain syndrome. Each orthopedic test consists of three essential components, 1. the mechanisms of the test, 2. what constitutes a positive finding and 3. what a positive finding indicates. The clinician must assess contraindications before submitting the patient to a provocative test.
Considerations

- Frequently tests which are mechanically the same or contain similar maneuvers have different names or different indication.
- While reviewing records take into consideration that teachers and authors suggest slight variations in procedures (look for consistency in interpretation).
- The accuracy and validity of any test will depend upon the stage and severity of the condition.

Range of Motion Testing — is a standard part of all inter-disciplinary assessments. Normals may vary slightly and are subject to interpretation depending upon stage and severity of condition. All orthopedic assessments must include a range of motion assessment if practical. In cases of severe tissue damage this procedure may be delayed for several days following an acute trauma.

Most Commonly Used Orthopedic Tests of the Cervical Region

_Cervical Compression_ — place both hands on the top of the patient’s head and gradually apply a downward pressure. Radiating pain is a positive, suggestive of nerve root compression.

Variations of Cervical Compression Testing

- Jackson’s Maneuver — adds a lateral flexion component to the compression test
- Cervical rotation with compression
- Maximum cervical compression — incorporates lateral flexion, rotation and extension and may include physician assisted compression
- Spurling’s— incorporates maximum cervical compression with a sharp tap “punch downward”

_Bokody’s Sign_ — reduction in radicular pain when patient’s hand is placed above the head. Positive sign is indicative of nerve root compression.

_Cervical Distraction_ — gently lifting of the patient’s head, positive findings include pain or relief. Pain is suggestive of muscular/ligamentous injury, i.e., sprain/strain. Relief is indicative of nerve root compression.

_Shoulder Depressor, AKA Dural Sleeve Stretch_ — application of a downward pressure to one shoulder with simultaneous lateral flexion of the head to the opposite shoulder. A positive finding includes radiating pain and is indicative of fibrotic dural sleeve adhesions. Radiating pain must be present for a positive finding.

_Soto-Hall_ — with one hand placed on the patient’s sternum, passively flex the patient’s head to their chest. Pain indicates possible sprain/strain injury or cervical fracture (especially compression fracture).

_Swallowing Test_ — instruct the patient to swallow. This test may have neurogenic overlay. Positive may indicate paravertebral mass or swelling such as in the case of Forester’s Disease, AKA Diffuse Idiopathic Skeletal Hyper exostosis or brain stem lesion. A thorough history will determine whether the patient had sustained direct trauma to anterior compartment of the neck.

_Lhermitte’s Sign_ — present when the patient experiences “electric” or “shock-like” sensations during cervical flexion. For example: this sign may be revealed during range of motion testing, performing Soto-Hall’s Test, etc. Could be indicative of cord lesion such as multiple sclerosis or meningeal irritation, possibly associated with infection.
Discogenic Assessment — test designed to reveal complications associated with intrathecal pressure, i.e., Dejerine’s Triad, Nafziger’s Test, a distinction must be made between these findings and those associated with the cervical compression testing maneuvers.

Neurologics

The neurology examination is designed to ascertain the integrity of the nerve system in the absence of any neurological deficit. In the case of neurologic involvement the examination is designed to locate the level of lesion and identify the nature and extent of the lesion. There are four components of the neurological examination:

1. MENTAL STATUS, 2. CRANIAL NERVES, 3. MOTOR FUNCTION, 4. SENSORY FUNCTION

Observation and Inspection — the examination begins with an overall inspection of the patient. Note any observable disturbances in the following:

- Diminished mental awareness and attentiveness, abnormal moods or personal hygiene
- Speech defects, or expressions or dysphagia
- Muscle weakness, unusual movements or mannerisms; loss of coordination, balance, gait, or fine motor control
- Alterations in position sense, as evidenced by gait and station

1. **Mental Status** — determine whether the patient had completed his/her own forms. Treatment in the presence of cerebral or cognitive dysfunction would be contraindicated with various therapies.

2. **Cranial Nerves**

- Olfactory Nerve — smell
- Optic Nerve — sensory. The light reflex. A light shined on the retina causes reflex pupillary constriction of that eye (direct light reflex) and also of the opposite eye (consensual light reflex). Accommodation is the process by which a clear visual image is maintained as the gaze is shifted from a distant to near point.

The three components of the reaction are: 1. convergence of the eyes; 2. pupillary constriction and 3. thickening of the lens through contraction of the ciliary muscles. Only the first two are visible to the examiner.

- Oculomotor Nerve — test with CN4 and CN6
- Trochlear Nerve — test with abducens (CN6) and oculomotor (CN3) motor extraocular movement — 6 cardinal fields of gaze, identifying paralysis, weakness, nystagmus, conjugate movement (eyes moving together).
- Trigeminal Nerve — sensory/motor — touch, pain, temperature, muscles of mastication, the trigeminal nerve has three branches including: ① ophthalmic, ② maxillary, ③ mandibular. Testing of trigeminal nerve through palpation, i.e., jaw jerk reflex or sensation w/ a cotton wisp in the three branches.
- Abducens Nerve — motor
- Facial Nerve — sensory/motor — taste (anterior two thirds) and facial expression — corneal reflex, using a cotton wisp against the cornea, the ability to feel is assessed by the trigeminal nerve. The blinking would be an assessment of the facial nerve.
- Vestibulo/Cochlear Nerve, i.e., balance and hearing
- Glossopharyngeal — sensory/motor — taste, posterior 1/3 of tongue and muscles of swallowing

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Vagus Nerve — sensory/motor — gag reflex — assessed by having the patient swallow and identifying dysphagia.

Spinal Accessory Nerve — sensory/motor — trapezius — SCM, test by having the patient turn head and shrug shoulders against resistance.

Hypoglossal Nerve — motor — musculature of the tongue.

3. Motor Function

Muscle Testing
- Bulk — circumference measurement
- Involuntary — hyperkinesia
- **Fibrillations** — spontaneous independent contraction of individual muscle fibers which is independent of cortical or spinal control.
- **Fasciculation** — spontaneous muscle twitching, this cannot be visualized. Both fibrillations and fasciculation are lower motor neuron lesions.
- **Tremors** — may be physiological or pathological

Tone — evaluated by the degree of resistance of muscle to passive range of motion. Tone is evaluated by:
- Contracture — a shortening of fibers due to trauma, chronicity or neurologic dysfunction.
- Hypotonicity — muscle is soft and flabby, joint is hypermobile.
- Flaccidity — absent muscle tone. Both hypotonicity and flaccidity are suggestive of lower motor neuron lesions.
- Spasticity — a resistance to range of motion also known as hypertonicity and is suggestive of an upper motor neuron lesion.

Muscle Strength is tested utilizing the standard muscle grading scale of 5 — 0
- 5 Normal full ROM vs gravity and full resistance
- 4 Good full ROM vs gravity and some resistance
- 3 Fair full ROM vs gravity
- 2 Poor full ROM vs no gravity or resistance
- 1 Trace muscle contraction, but no joint movement
- ZERO no evidence of muscle contraction

All muscle strength is assessed bilaterally

Myotome — assessing muscles by a particular cord level. Assessment of the brachial plexus includes evaluations of C5 - T1:
- C1 - 4 difficult to isolate
- C5 arm abduction and forearm flexion — deltoid and biceps
- C6 includes wrists extensors
- C7 includes wrist flexor
- C8 includes finger flexors, i.e., grip
- T1 includes finger abductors
- General testing of muscle function of the cervical region can be performed by: 1. Lifting head from supine position; 2. extending neck from prone position; 3. hand grip; 4. abduct arms fully.

4. Reflexes — are defined as “involuntary motor responses to noxious stimuli.” The components of the reflex arc include deep tendon reflexes, superficial reflexes including cutaneous and mucus membrane, viscero/organic and pathological.
**Deep tendon reflexes** — “stretch” or “myotatic” reflexes test the component of the voluntary motor system. The receptors that detect stretch are the muscle spindle and tendon organs. The normal response to stretch is muscle contraction. The tendon reflex are assessed using the **Wexler scale** which is rated as follows:

- 0 - Absent (with reinforcement)
- 1 - Hypoactive (or normal with reinforcement)
- 2 - Normal (to hypoactive)
- 3 - Normal (to hyperactive)
- 4 - Hyperactive
- 5 - Hyperactive (with clonus)

**Deep tendon reflexes** of the biceps, brachioradialis and triceps are performed to evaluate afferent nerve (sensory) and efferent nerve (motor) function at integrated cord levels, i.e., biceps is integrated at C5, brachioradialis at C6 and triceps at C7.

**Superficial reflexes** — these are muscular responses elicited by the irritation of the afferent neuron on the surface of the body, especially on the skin or the mucus membrane. Superficial reflexes involve a cerebral arc. For example, the previously discussed corneal reflex.

**Visero/organic reflexes** — these reflexes involve the brain stem as the integrating center and use a cranial nerve as either the afferent or the efferent (or both) portion of the reflex arc.

**Pathological reflexes** — abnormal, inappropriate muscular responses to various stimuli. The presence of these reflexes are a sign of corticospinal tract disease (pyramidal tract lateral columns), indicative of an upper motor neuron lesion.

**Sensory Function**

Dermatomes and Peripheral Nerve Zones — isolation of the area and extent of sensory involvement will help identify the location of the nerve lesion. Segmental innervation of the skin (by a single nerve root) is called a dermatome. Knowledge of these areas offers the examiner a quick measure to assess the posterior horns of the spinal cord and the areas of distribution. Dermatomes are used to identify the level of skin lesions.

A peripheral nerve involvement will also demonstrate a specific sensory distribution and any sensory involvement should be compared with peripheral nerve zones.

It must be noted that dermatomes are neither specific or constant. A dermatome is a cutaneous area dominated by a single nerve root. This area will also be supplied to some extent by the nerve root above and below. It is for this reason that there are many different dermatome charts.
**Exteroceptive, Proprioceptive and Discriminatory Functions**

After localizing the extent of involvement, identify the pattern of sensory disturbance.

**Exteroceptive** sensation is a classification concerning receptors located on the surface of the body. Core transmission occurs along the spinothalamic tracts. The **three types** of **exteroceptive** sensation are touch, pain, temperature.

**Proprioceptive** sensation — is located deep in the body in the muscle tendon and joints. Proprioception is transmitted along the posterior columns. The **two types** of **proprioception** are positional sense and vibratory sense. Loss of vibratory sense is called “paraesthesia” and is detected by using a 128 cps tuning fork.

**Discriminatory** sensation requires cortical interpretation, normal exteroceptive and proprioceptive receptors. There are **six types** of **discriminatory** sensations including: 1. stereognosis (object identification), 2. two point discrimination, 3. tactile localization, 4. graphesthesa, 5. barognosis (weight) and 6. extinction (only unilateral sensation).

**Chiropractic Analysis** — which includes motion palpation, static palpation of bony and muscular structures, components of previous range of motion assessments.

Incorporation of information derived from radiographic evaluation, instrumentation and laboratory studies.

**X-ray of the Cervical Spine**

The cervical spine is a critical neurological area which is particularly susceptible to mechanical and congenital disturbances.

**Lateral Cervical**

Used as a scout film to detect the general structural and mechanical state of the spine. As with all lateral projections of the spine, study the film vertically, and from anterior to posterior.

- **Anterior Spine** — analyze for chip fractures; spurs; ligamentous calcification (seen in Marie Strumpell’s disease); compression fractures
- **Articular Pillars** — a posterior George’s line should form a smooth continuous curve. Ankylosing of the articular pillars is seen in Marie Strumpell’s disease.
- **Posterior Spine** — a spinal laminar line of mensuration should be present, C shaped and form a smooth curve. An interruption is suggestive of spina bifida.
- **Upper Cervical Area** — 1. Analyze the C1 and occiput relationship for basilar invagination or occipitalization; 2. Atlanto — Dental Interval — any increase or decrease suggests rheumatoid arthritis or ligament tear; 3. Posterior arch of atlas for fracture or agenesis; 4. Axis — hangman’s fracture or os odontoidideum.

**Lateral Stress**

The hyper-flexion and hyper-extension views are used to detect structural or mechanical abnormalities, specifically; fracture, fusion or a ligamentous problem.
Cervical Obliques

Used to visualize the Intervertebral Foramen (IVF). The top and bottom of the IVF is formed by the pedicles. The front is formed by the uncinate processes and body. The back of the IVF is formed by the superior articular process.

Assessment of Cervico-Brachial Neurovascular Compression Syndromes

These tests (also known as Thoracic Outlet Syndrome assessments) have common findings. The patient presents with arm and hand pain — pain in the ulnar side of the hand — pain and paraesthesia of the hand — atrophy and weakness of the hand. There are four tests classically associated with assessing the neurovascular compression syndrome:

Allen’s — always performed initially is designed to assess arterial occlusion. It is essential that the Allen’s test be performed first to determine the patency of the radial and ulnar arteries as the other tests (Adson’s, Eden’s and Wright’s) use the radial artery as their primary indicator. With the arm fully abducted, a tight fist is made, as to express blood from the hand. Compression of the radial artery by the clinician as the palm of the hand is lowered and each artery is released for observation. A positive finding suggests extended pallor and blanching of the hand. Positive findings are suggestive of occlusion of the radial or ulnar artery.

Adson’s — to evaluate Scalenus Anticus Syndrome. Monitor the radial pulse and hyperextend the patient’s arm. A positive finding relates to diminished or obliteration of the pulse or a replication of the presenting symptomatology. This is known as Scalenus Anticus Syndrome. Commonly, this condition responds favorably to chiropractic treatment management utilizing adjustments of the spine and muscle therapy.

Eden’s — locate and monitor the patient’s radial pulse and bring the arm into hyperextension. The patient assumes the military position of attention. A positive finding suggests diminished or obliterated pulse or reduplication of the presenting symptomatology. Positive findings are suggestive of Costoclavicular Syndrome.

Wright’s — also known as hyperabduction. The clinician palpates and monitors the patient’s pulse and slowly takes the arm through full abduction. Positive findings reflect diminished or obliterated pulse and/or a replication of the presenting symptomatology. Positive findings are suggestive of hyperabduction syndrome, also known as Pectoralis Minor syndrome. The patient should be instructed to limit overhead motions.

George’ Test “Cerebrovascular Cranio cervical Functional Test”

George’s test is a screening procedure used to identify potential stroke patients. It should be used on any patient over 18 years old.

PART I: History

Questions are asked concerning the cardiovascular system and related symptomatology. Affirmative answers are presumptive evidence of a high risk patient. Any history of stroke, diabetes mellitus, hypertension or arteriosclerosis.
PART II: Integrity of the Subclavian Arteries

A. Blood pressure reading is taken of both arms and the systolic pressures are compared. A difference of 10 mm Hg is significant for a possible artery occlusion on the side with the low reading. A follow-up procedure would be to then palpate and determine if the radial pulse on the low side is feeble or absent.

B. Auscultate the subclavian arteries

PART III: Integrity of the Carotid Arteries

A. Palpate the carotid arteries — look for a weak or absent pulse
B. Auscultate the carotids for bruits (a sound caused by turbulent blood flow due to occlusion)

If Parts II and III are positive, DO NOT PERFORM STEP IV.

PART IV: Vertebro-basilar Artery Functional Maneuvers

This portion of the test is designed to compress the contralateral vertebral arteries. Positive indicators of occlusion would be signs of cerebral ischemia, i.e., ① nausea, ② nystagmus, ③ fainting, ④ vertigo

A. Left Maneuver — patient is asked to hyper-extend and rotate the head to the left for 3 to 5 seconds. Observe for positive indicators. If you obtain a positive at this point, DO NOT PROCEED.
B. Right Maneuver — patient is asked to hyper-extend and rotate their head to the right for 3 to 5 seconds. Watch for indicators.

If Park II, III or IV are positive, refer to a cardiovascular specialist.

ASSESSMENT OF THE THORACIC AND LUMBAR SPINE

THORACIC SPINE

There are two general origins of thoracic pain:
1. Neuro/Musculoskeletal
2. Referred from the viscera of the chest or abdomen

Anatomical considerations
Articular processes — these are vertically oriented with the inferior surface interlocking with the inferior vertebrae preventing anterior displacement. With this bony stabilization there is seldom true anterior displacement in the absence of fracture of the pars, lamina or the articular facet. Anterior displacement on x-ray may be suggestive of the presence of fracture.

Vertebral bodies — the thoracic vertebrae is higher posterior than anterior. This gives rise to the convex curve or kyphosis.

Rib attachments — these reinforce the thoracic spine by attaching between two vertebrae at the demifacets preventing lateral flexion and limiting rotation.
**Intervertebral discs** — the disc is more narrow and thinner than those of the cervical and lumbar spine. The disc is always less elastic which reduces the cushioning affects to only those against long axis loading.

**Physical examination of the thorax**

**LUNGS**

The right lung has 3 lobes and the left has 2 (upper, lower and oblique in the right). The apex of the lung is located approximately 2 - 3 cm above the middle clavicle and its outer edge runs down to the mid-clavicular line at the level of the 6th rib and the mid-axillary line at the 8th rib. The bifurcation of the trachea occurs at the level of T4 and anteriorly at the angle of Louie.

**Inspection**

- **Structures**
- **Shape**—Slope—Interspaces
- **Respiratory** —Rate—Rhythm

**Structures** —shape of the thorax —hemithoraxes should be equal, and the ratio of the chest diameters (A-P: Lateral) is 1:2 ratio

- **Slope** —of the ribs relative to the spine normally is 45°
- **Interspaces** —should be neither bulging or retracted
- **Respiratory Rate/Rhythm** —normally is about 14 - 18 breaths per minute for every degree increase due to fever you increase breathing by 4 breaths per minute

**Percussion —two types**

1. **Definitive** —used to locate and determine the extent (size) of an organ based on the intensity, pitch, quality and duration of the sound. Normal sounds are:
   - Resonant —lung
   - Dull —heart, liver
   - Flat —muscle
   - Tympanic—any gas containing structure, i.e., stomach
2. **Sonorous** —detects the relative density of the organs. Percuss for abnormal or displaced percussive sounds

**Auscultation**

**Breath Sounds**—have the patient breath through a slightly opened mouth. Listen for the pitch and duration of inspiration to expiration. (This duration varies with the areas of the lung.) Auscultate for displaced sounds.

- Vesicular Sounds —inspiration is greater than expiration
- Bronchial Sounds —inspiration is less than expiration

**Voice Sounds**—auscultate the quality and intensity of sounds when the patient speaks. Normally words are not discernible and will only be heard in abnormal conditions.

- Bronchophony —increase in intensity and clarity of words
- Egophony —words have a goat-like sound
- Whispered Pectoriloquy —increased clarity of whispered words
Adventitious Sounds

- Moist Rales — sounds produced by gas bubbles in small airways
- Dry Rales — due to thick secretions in airways

Palpation Structures — for cutaneous abnormalities, tenderness, nodules and masses. Also repeats crepitus due to subcutaneous emphysema. Palpates as bubbles under the skin. Friction rub due to dry pleurisy (palpates as two pieces of leather rubbing together).

Fremitus — a palpable vibration occurring when the patient speaks. Fremitus is more apparent with louder speech and more easily detected in males. Palpate the thorax while the patient says “99” or “eeeee.” Fremitus is caused by air vibrations.
Abnormalities: 1. Tussive fremitus—due to coughing; 2. Rhonchal fremitus—due to the presence of excudates in the bronchi.

Respiratory Excursions — test for timing and distance (is there lag time or limited expansion of the chest during both inspiration and expiration?)

HEART

Inspection — note the apical impulse located at the fifth intercostal space on the left below the nipple. Palpate the point of maximum intensity (PMI). Percuss the borders of cardiac dullness to determine size and displacement. Auscultate for regular rate and rhythm of the heart. Systolic murmurs are loud. Diastolic murmurs are pathological. Auscultate the aortic, pulmonic, tricuspid and mitral valves.

- Aortic Valve — located at the second intercostal space on the right
- Pulmonic valve — second intercostal space on the left
- Tricuspid valve — fifth intercostal space on the left near the sternum
- Mitral Valve — fifth intercostal space at the mid clavicular line on the left

ORTHOPEDIC EXAM OF THE DORSAL SPINE

Inspection — assess discoloration, bumps, abrasions, signs of local contusion, swelling, lipomas, fibromas or sebaceous cysts. Inspection would include trans illumination of lumps or bumps to assess whether these are serous fluids, lipid tissue, hematoma, hemangioma or other hematological disorders.

Palpation — bilateral comparisons assessing tone & general characteristics, assessing structure & shape taking into consideration subluxation, kyphosis, scoliosis and asymmetry.

Common Orthopedic Tests

Spinal Percussion — first performed with the heel of the hand to assess fracture or with fingers or reflex hammer when indicated. Assess possibility of spinal fracture, intervertebral disc disruption or intercostal neuritis. Poorly localized pain is suggestive of muscular strain, pain with radiation is common with ligamentous sprain.

Soto Hall — previously discussed in cervical spine assessment. Positive may be suggestive of ligamentous strain in the dorsal spine. One must take into consideration the contribution of infectious illness. SIDE NOTE: presence of lateral rib pain is a sign of rib fracture.
**Beevor’s Sign** —used to evaluate the neurologic integrity of the thoracic cord. Patient is supine and asked to perform a partial sit up while the doctor observes the umbilicus. A superior drift of the umbilicus indicates a cord lesion at the T10-12 area, while an inferior drift indicates the lesion in the T7-10 area of the cord. The test is not specific for type of lesion, but will make the doctor aware of its existence.

**Schepelmann’s Sign** —this test identifies the integrity of the ribs and inflammation of the pleural membrane. Performed with the patient seated holding the arms overhead. The patient is then asked to laterally bend as far as possible without rotating the body. Pain noted on the concave side is an indication to investigate for intercostal neuritis while pain on the convex side is an indication to check for possible pleural adhesion or inflammation.

**Chest/Rib Expansion** —an assessment for ankylosing spondylitis. Adult male chest expansion during full expiration to full inspiration is approximately 2 inches while the female is approximately 1.5 inches. Testing is done by grasping the ribs from behind and approximating the thumbs as the patient expires fully and observe the distance between the thumbs when the patient achieves full inspiration.

**Special Considerations**

**Sprengel’s Deformity** —fixation of one scapula higher than the other is characteristic of this condition with levator scapula replaced by osseous tissue —known as the suprascapular bone.

**Myofascial Pain (MPS)** —also known as myofascial pain syndrome, fibromyalgia syndrome, and delayed onset muscular soreness. None of these findings have a definitive laboratory or imaging test, none has an established etiology and all three interact confusingly and strongly together.

MPS —spot or point tenderness in palpable band of muscular fiber causes a distinct and characteristic referred pain pattern that is not always dermatomal, myotomal, or sclerotalomal. Travell and Simon describe a trigger point as a tender area within the belly of the muscle causing a distinct and characteristic referred pain pattern with pressures applied which exists on a shortened, tight, palpable band within the muscle, and is stimulated by a needle or tapping palpation which causes a “jump” response. These authors suggest that injection of the trigger point with Procaine abolishes the local and referred pain response to pressure. Suggested treatments have consisted of vitamin therapy (B1, B6, C and Folic Acid), electrotherapy, transverse friction massage, infrared laser stimulation, acupuncture, vapocoolent spray an stretch technique and chiropractic specific techniques such as Nimmo.

**Fibromyalgia Syndrome** —(from the American Journal of Pain Management, October 1992) the definition of Fibromyalgia as established by the College of Rheumatology criterion committee:
- Widespread pain history with pain in four quadrants of the body
- Pain on digital palpation in at least 11 of 18 characteristic locations
- Tender point sights to a possible 4 kilograms of digital pressure
- General characteristics include complaints of “pain all over,” generalized fatigue, chronic headaches, morning stiffness and sleep disturbances. Secondary syndromes include irritable bowel syndrome or Raynauds’-like vascular instability. The typical characteristics of the FS patient include personal qualities as caring, honest, committed, moral, industrious, a worrier and a perfectionist. Treatment options are not designed to be curative, but gravitate to management. Treatment options include: patient education, encouragement, medicine options, natural agents such as tyrosine (amino acids), tryptophan, physical therapies include heat, massage, stretching exercise, ultrasound, adjustments, acupuncture, spray/stretch and other muscle relaxing modalities. Stress release is recommended, proper sleep patterns are required.
Middle and Lower Trapezius Sprain Syndrome  
Condition of chronic muscle strain  
- Habitual postural rounded shoulders  
- Over development of pectoralis group  
- Large breasts  
- Burning pain  
- Recumbency tends to relieve  
- Patient benefits from clavicular support, massage, heat and manipulation

**Coracoid Pressure Syndrome** — compression or irritation of the brachial plexus due to the coracoid process of the scapula being pulled forward.

**Teres Syndrome** — patient presents with position of internal rotation due to a tight Teres major muscle.

**Referred pain from visceral origins**  
- Tumors or aneurysms, evidenced by boring pain in thoracic spine (check for time of day, age of patient, sex, etc.)  
- Respiratory illness  
- Ulcers  
- Hiatal hernia, mid back or band-like chest pain  
- Gallbladder, i.e., cholecystitis and cholelithiasis  
- Murphy’s sign — referral to right scapula or right shoulder, commonly the four F’s: “Fat, Female, Forty, Fertile.”

**Stenosis of the Thoracic Spine**  
- Hypertrophy of the posterior ligamentous structure  
- Herniation of the disc  
- Trauma  
- Tumors

**Thoracic intervertebral disc herniation** — most common from T7 - T12. The effects of spondyloarthrosis may magnify the significance of the disc bulge.

**Disc Infection** — generally post surgical and may be spread from surgical intervention to the GI or GU tracts

**Straight back syndrome** or pseudo-heart disease — generally asymptomatic, but the presence of kyphosis contributes to objective findings consistent with heart disease such as pseudo cardiomegaly or mechanical murmurs.

**Robert’s Syndrome** — this is a costotransverse arthrosis of the 10th segment usually found on the right side with visceral symptomatology. Look for localized pain over the 10th costotransverse articulation or a slightly more diffuse distribution.

**Tietze’s Syndrome** — this condition is characterized by pain and tenderness in the upper costochondral cartilage. The cause is unknown, but often associated with trauma, i.e., a seat belt injury. Standard treatment includes rest, analgesics and physical therapy to reduce the inflammation.

**Scapula Costal Syndrome** — the bursae and other soft tissues of the scapular thoracic interval are
sensitive to abnormal friction and pressure which results from poor mechanics of the scapula. This is often associated with poor posture and leads to fatigue through the progression of the day.

**LUMBAR SPINE**

**Common Orthopedic Tests**

**Well Leg Raise** — also known as the contralateral Lasegues. The clinician lifts the unaffected leg, production of pain in the affected leg is considered a positive for probable sciatica due to disc herniation.

**Laségue’s** — bent leg is extended and lifted. There is a debate as to whether a finding from 0° to 30° would be considered associated with a lumbar disc. Several sources suggest that positive in the 0° to 30° range is more consistent with muscle spasm or sacroiliac instability.

**Straight Leg Raise** — With the patient supine, the clinician will lift the affected leg, with knee straught up to 90° if possible. Inability to perform due to muscular contracture or radiating pain would be considered a positive.

**Braggard’s** — Patient supine, following a positive straight leg raise, the leg is lowered 5° and dorsiflexion is applied. Generally, a positive would be considered a non-disc sciatica. Some sources indicate that it may be suggestive of a post medial disc lesion.

**Fajersztajn’s** — Also known as the contralateral Braggard’s, equal findings are associated with the Braggard’s procedure applied to the unaffected leg.

**Bechterew’s** — With the patient seated, he/she lifts the affected leg, then lifts the unaffected leg, then lifts both legs. In the presence of discomfort or pain in all three procedures it will be suggestive of disc lesion. **Tripod sign** is a clear suggestion of a positive Bechterew’s test.

**Bow Strings** — With the patient in the straight leg raise position, the affected knee is flexed slightly and pressure is applied to the popliteal fossa. Reproduction of leg or back pain (not pain over popliteal fossa) is considered a positive. Dr. Mazion suggests that this test is the most important orthopedic sign for intervertebral disc syndrome. It is his opinion that this test is irrefutable evidence of a nerve root compression.

**Goldthwait’s** — “Digging for gold.” With the patient supine, the clinician’s hand is placed under the lumbar region. Pain before lumbar movement is considered a sacroiliac or hip lesion. Pain after lumbar movement is considered a lumbar or lumbosacral lesion.

**Gaenslen’s** — With the patient supine, near the edge of the table, the leg is extended off the table. The inside knee is flexed to the abdomen. A positive response is suggestive of a sacroiliac lesion. This procedure is contraindicated in the elderly or pregnant patient.

**Nachlas’** — With the patient prone, the heel is approximated to the buttock while downward pressure is applied to the pelvis. Pain is suggestive of a positive sacroiliac or lumbosacral lesion.*

* Pain in the upper lumbar or femoral radicular pain suggests femoral neuropathy which is known as femoral nerve stretch test.

**Ely’s/Hibb’s** — Ely’s sign occurs when the heel is flexed to the buttock and the hip arises from the table. This is suggestive of rectus femoris contracture.

- **Ely’s test**, the heel is flexed to the buttock on the opposite side. Positive findings are suggestive of...
hip lesion, irritation of the iliopsoas muscle, inflammation of the lumbar nerve root and lumbar root adhesions.

- **Hibb’s test.** is performed when the prone patient’s knee is flexed to 90º or better than lateral rotation is applied. Pain on this motion is considered a positive suggestive of S1 lesion.

**Iliac Compression** — With the patient in a side lying position, pressure is applied to the pelvis for 30 seconds. Pain on this maneuver is considered a positive for sacroiliac lesion. This test is also contraindicated in pregnant women and the elderly.

**Muscle Testing** — primarily four movements are evaluated to assess potential motor root dysfunction. This would include: bilateral hip flexion to assess root levels L1 - L3, dorsiflexion to evaluate L4 level, toe extension to evaluate the L5 level and plantar flexion to evaluate the S1 level.

**Range of Motion** — May vary from text to text. Rough estimates on lumbar range of motion are 90º in flexion, 30º in extension, 30º in left and right rotation and 20º in left and right lateral bending.

**Reflexes** — primarily, an assessment of the lumbar nerve roots would include percussion of the patellar (L4) and the achilles (S1) reflexes.

**Sensory Exam** — Dermatomal distribution and peripheral nerve zones. Exteroceptive, proprioceptive and discriminatory function.

**Ancillary Diagnostic Procedures**

**Common Conditions**
- Acute sprain/strain
- Chronic sprain/strain
- Intervertebral Disc Syndrome
- Scoliosis
- Asymmetrical Facets/Facet Syndrome
- Anomalies, i.e., lumbarization, sacralization, pseudo joints

**Differentiation** — Utilizing orthopedic tests and other comparative examinations to assess diagnostic impression, differential diagnosis.

**Example:** Intervertebral disc syndrome. Findings may include positive minor sign, positive Valsalva maneuver, which is correlated by positive Bechterew’s. Performance of straight leg raising test (i.e., Lasegue’s) and associated stretch irritation maneuvers. F. Steven Barron, D.C. (Fundamentals of Chiropractic Diagnosis and Management) indicates that the average patient is able to raise the leg 70º to 90º, pain produced during the first 15º is said to be caused by irritation of the lumbosacral musculature. Therefore, a positive test for the SLR is production of radicular/radiating pain between 25º and 70º of leg flexion. Upon suspicion of intervertebral disc syndrome it is important to assess a level of nerve involvement.
For example: L3 disc involved the L4 nerve root with the pain distribution down the lower back, postoral lateral thigh and anterior leg. This may demonstrate weakness of quadriceps and decrease patellar reflex. L4 disc would demonstrate an L5 nerve root irritation which would produce pain over the sacroiliac joint, hip and lateral leg down to the web of the first and second toe. Weakness may be demonstrated in the dorsiflexion of the great toe and foot. Generally, there is minimal change in reflex and atrophic changes. The L5 disc would involve the S1 nerve root. This will present with pain over the sacroiliac joint, hip, posterolateral thigh and leg into the heal and lateral side of the foot. Numbness is noted on the posterior calf, lateral heal and small toe. Depending on the stage of condition, atrophy may be noted in the calf. Toe walking would become difficult and the achilles reflex would be decreased.

Additional Orthopedic Tests

**Kemp’s** —Have the patient (seated or standing position) hyperextend and rotate to one side and then the other.
+ Radiating pain
= Sciatic radiculopathy due to disc herniation

**Dejerine’s Triad** —
+ Pain is elicited upon: a. Coughing, b. Sneezing, c. Straining at the stool
= A space occupying lesion. Example, disc herniation or spinal cord tumor

**Valsalva’s Maneuver** —Have the patient hold their breath and “bear down.”
+ Localized or radicular pain
= Space occupying lesion

**Naffzizer’s (Jugular Compression Test)**—bilaterally compress the patient’s external jugular veins up to 30 - 45 seconds. Ask the patient to cough.
+ Localized or radicular pain
= Space occupying lesion

**Milgram’s** —The patient (supine) lifts both legs several inches off the table and holds the position for as long as they can.
+ Localized or radicular pain
= Space occupying lesion

**Lindner’s** —With the patient supine, passively place their spine into full flexion.
+ Radicular pain
= Nerve root compression

Orthopedics of the Lower Extremity

**Abduction/Adduction Stress Test** —Stabilize and A) abduct the lower leg while applying a lateral to medial (valgus) stress to the knee; then B) abduct the lower leg while applying a medial to lateral (varus) stress to the knee.
+ Joint laxity and/or pain
= A) Tibial collateral ligament involvement —pain with a valgus stress
= B) Fibular collateral ligament involvement —pain with a varus stress
**A - P Drawer Sign** — The patient lies in the supine position the knees flexed to 90°. Stabilize the and grasp the leg distal to the knee joint. Your thumbs should lie across the knee joint. Slowly A) the tibia toward you (anterior cruciate); then B) push the tibia away (posterior cruciate ligament).

+ Pain and/or joint laxity  
= A) Anterior cruciate damage — pain with an anterior drawer  
= B) Posterior cruciate damage — pain with a posterior drawer

**Apley’s Compression/Distraction** — The patient lies prone with the knee flexed to 90°. A) Apply a downward pressure (compression) on the patient’s foot; then B) stabilize the thigh and pull up on the patient’s leg (distraction).

+ Pain upon  
= A) Meniscal involvement — pain with compression  
= B) Collateral ligament involvement — pain with distraction

**McMurray’s** — With the patient supine, place one hand over the knee joint and grasp the foot with the other. Externally rotate the foot and apply a medial to lateral (varus) stress to the knee. From 90° knee flexion, slowly extend the leg.

+ Pain or crepitation  
= Medial meniscal involvement

**Homan’s** — The patient lies supine with the leg fully extended. Forcibly dorsiflex the foot.

+ Pain in the area of the calf or resistance to dorsiflexion  
= Deep thrombophlebitis

**Patellar Grinding** — The patient is in the supine position with the legs extended. Push the patella distally and hold while the patient contracts the quadriceps.

+ Crepitation or pain  
= Patellar articular disturbance such as chondromalacia patella

**Patellar Apprehension** — Push the patient’s patella laterally.

+ The patient displays an expression of apprehension  
= Chronic patellar dislocation

**Orthopedics of the Upper Extremity**

**Abduction/Dawburn’s Sign** — Hold point of pain and abduct.

+ Subacromial bursitis

**Apprehension of Shoulder** — Push arm into abduction and rotation (pitching position)

+ Chronic or acute shoulder irritation

**Codman’s Sign** — Pain or weakness when abducted arm is no longer supported by physician

+ Rotator cuff tear, probably rupture of supraspinatus tendon

**Dugas’ Test** — Patient touches opposite shoulder and raises elbow

+ Pain or inability associated with dislocation
Cozen’s Test — Counter force against dorsiflexed fist
+ Pain (Lancinating)
= Epicondylitis or Radiohumeral bursitis

Yergason’s — Distract arm, rotate hand, grip bicep tendon
+ Loss of stability of bicep tendon

Tinel Sign — Tap site of injured nerve
+ Transient, painful, tingling
= Peripheral nerve interruption or symptoms of regeneration

Phalen Sign — Hyper flexion of wrist
+ Probable carpal tunnel compression