

PHYSICAL EXAMINATION OF THE PAIN PATIENT

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GENERAL:

All examinations must be conducted with the patient suitably gowned and chaperoned. The examination has commenced with the history which gives indication of the patient's attitudes, intelligence, honesty, and apparent (dis) comfort.

SEVERAL PRINCIPLES APPLY:

1. Since any tissue can give rise to pain, including referred pain, the examination must include the viscera, bones, joints (ranges of motion), neurological and musculoskeletal systems.
2. Inspection, palpation, percussion, and auscultation must be augmented by tests of range of motion, joint exam, and special testing.
3. Validation tests including dynamometer readings (Jamar), distraction techniques (seated vs supine straight leg raising signs) Waddell's test, Baker's and Hoover's tests must be employed.
4. Since pain and dysfunction trend together, normal function parameters at various ages must be known for gait, coordination, motor, sensory, and reflex function.
5. You must learn through lifetime study, what is under the indicated area of pain, what it is attached to, how it works, and where it could be referred from.

6. Requisite knowledge is required from:

Neurological exam: Mental status, cranial nerves, motor power, deep tendon reflexes, sensation, meningeal signs.

Orthopedic exam: Joint play, ranges of motion, maneuvers to produce joint pain.

Physiatry: Motor power, atrophy, coordination at each joint.

Dermatological: Painful skin lesions such as herpes, plantar warts, neurodermatitis.

Internal medicine and surgery: Chest examination including chest wall and percussion and auscultation.

Abdominal exam: Including bowel sounds, tenderness, organomegaly.

Extremity exam: Including pulses, venous competency and painful lesions of the skin, muscles, subcutaneous tissues, lymph nodes, and long bones. GENERAL REFERENCES

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PHYSICAL EXAMINATION OF THE HEAD AND NECK

Examination of the head and neck is an almost instinctive part of the physical examination. In history taking if performed for any period of time, one can't help but notice the facial expression, symmetry of the head, relationship of the head to the neck, and general movements of the neck.

Just how much attention is focused on the head and neck depends in large measure on the clinical presenting problem of the patient. However, important clues to systemic disease, skeletal anomalies and the psychological makeup of the patient are among a few of the many rewards for examination of the head and neck.

The examiner must decide the extent of the examination based upon the complaints of the patient. If there is pain in the face or neck, or there is a generalized neurological condition, then considerable attention must be paid to the head and neck. If the patient has pain in and about the jaw an effort to delineate the pathology should be made, but referral to a dental specialist or ear, nose and throat physician may become mandatory. Similarly if the patient has a problem with the eye, an effort should be made to ascertain its extent and acuity and possible relationship to the pain problem. But again, referral to a specialist with access to specialized testing equipment and procedures may be necessary. The same holds true for examination of the nose, throat and particularly the larynx.

Examination of the head begins with the purpose of gaining an impression of the shape and

functioning of the head. The patient should remove eyeglasses, hair ornaments, if possible any hair pieces, and should sit at eye level with the examiner. The examination starts with inspection, continues with percussion and palpation, and goes forward to auscultation. First, consider the size and shape of the head, measuring it if necessary. Percussion of the head and face generally is done for the discernment of pain. (2) The position of the head should next be noted. (1) Is it in line, tilted to one side or rotated? Exaggerated forward thrust may be a result of the presence of cervical spine disease. (1,5)

Not to be neglected are movements of the head which may be seen in movement disorders such as Parkinsonism, benign cerebellar tremor, tics, Tourette syndrome, or torticollis. Movements of the head may even be a sign of cardiac disease, as in aortic insufficiency where there is a to and fro bobbing of the head noted.

The size and shape of the head should be noted. In hydrocephalus there is a large size and bulging forehead. There may be other anomalies of the head such as tower skull, and there may also be a cranial and facial hyperostosis.

Asymmetrical enlargement may be noted in Paget's disease and prominent frontal bossing and exophthalmus in Apert's syndrome.

Tumors and other growth should be sought. Defects in the skull should also be noted.

Signs of head trauma are sometimes seen.

A port wine stain such as is seen in Sturge-Weber disease may be quite prominent.

Obvious enlargement of the face and skull may be seen in acromegaly.

Examination of the face should be performed for the facial expression of the patient, and for the determination of a concordance between the patient's complaints of pain and the facial expression. Numerous systemic conditions may be noted in the face such as pallor, cyanosis, argyria, and jaundice. The massive face, craggy eyebrows, prominent nose and enlarged lower jaw form a characteristic and unforgettable picture of acromegaly. Even such a rare condition as leprosy may be noted. A Parkinsonian facies is generally expressionless with elevated eyebrows, facial immobility and infrequent blinking. Oftentimes patients with Parkinsonism will complain of various joint pains, and especially back pains, and the omission of the examination of the face may cause an opportunity to be lost.

General inspection of the eyes, ears, nose and throat should be carried out. An ecchymosis on the mastoid process (Battle's sign) may give evidence for remote history of head trauma. The cranial nerves (5) are then examined. Examination of the face for trauma (3) includes palpation of the face, upper orbital rim, lower orbital rim, nose, mandible and maxilla.

A specialized examination of the eyes may be carried out in appropriate circumstances. Examination of the jaw should be carried out as well as the oral contents. The extent of mouth opening, auscultation over the temporomandibular joint (4) and special meniscal dysfunction tests can be carried out. The cotton roll test is used in patients with degenerative arthritis to determine whether or not a splint would be beneficial.

Examination of the 12 cranial nerves then proceeds. These are well known to every examiner and contained in standard textbooks. (4,5) The table includes the chief functions and distributions of the cranial nerves.

Unilateral or bilateral enlargement of the parotid glands may be seen in mumps, Mikulicz's syndrome or Sjogren's. Palpation of the lymph glands in the neck can be done most easily if the patient is undressed to the waist, but lightly gowned, and the lymph glands in the neck are found most easily if one stands behind the patient. Palpation proceeds systematically, starting in the submental region, next palpating the submandibular region then the medial triangle, the sternocleidomastoid muscle and also under it, paying especial attention to the supraclavicular lymph glands. The pre and post auricular glands should be palpated as should the lateral triangle.

Myofascial pain syndromes are more commonly recognized today than previously. Palpation of the muscles of the face include the masseter muscle, the digastric muscle, the temporalis muscle, and the lateral pterygoid muscle (6,7).

The range of neck motion should also be ascertained and notation made of any spasticity or other abnormality. Movement disorders of the neck manifest themselves by abnormal postures and turning as well as abnormal resistance. Various craniovertebral abnormalities may be noted. Auscultation of the neck should be carried out for bruits and in addition to palpation over the thyroid gland auscultation of the thyroid gland are also noted. PHYSICAL EXAMINATION OF THE HEAD AND NECK

References

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PHYSICAL EXAMINATION OF THE NECK AND CERVICAL NERVE ROOTS

The physical findings in examination of the cervical spine are of two types. There are in most patients with cervical disc disease certain non-specific findings which do not help to localize the level of the pathological process. There are other findings, particularly the neurological abnormalities which help the examiner to accurately localize the level of the lesion. (1)

EXAMINATION OF THE NECK

A general physical examination of the patient should be carried out. It is the practice of this examiner always to have the patient walk prior to disrobing so as to ascertain if there is any abnormality of gait such as spasticity, foot drop, weakness or pain. Further at this time, the general posture of the patient which may seriously impair cervical function and produce cervical pain may be assessed. The position of the head in relationship to the neck should be considered. Is there torticollis, tilting of the head, an increase in the normal kyphosis of the thoracic spine leading to a compensatory cervical hyperlordosis? Following completion of the general inspection obvious protruding masses, scars and skin change should be examined.

At this point surface anatomy becomes important. The sternocleidomastoid running from one corner to the other of a quadrilateral area formed by the anterior mid line, the clavicle, the leading edge of the trapezius and the mastoid-mandibular line divides the sides of the neck into the anterior and posterior triangles. The posterior triangle contains little which is visible on inspection, but palpation of the base of the triangle finds the first rib crossed by the subclavian artery, the lower trunks of the brachial plexus and perhaps a cervical rib or its fibrous prolongation. Higher, the accessory nerve, running forward to the sternocleidomastoid divides the triangle in the upper area of the transverse processes of the cervical vertebra, and can be felt on deep palpation. In the anterior triangle the external jugular vein and the platysma (the superficial muscles of the neck), cross the sternocleidomastoid and both stand out in the thin individual. The body of the hyoid moves with swallowing. Below the body of the hyoid, the neurovascular bundle can be compressed against the carotid tubercle of the sixth vertebra. In the apex of the triangle, the transverse process of the atlas is palpable immediately behind the carotid artery and the fingertip can roll over the tip of the styloid process and the stylohyoid ligament. In the anterior mid line can usually be seen and always felt the anterior arch of the hyoid, the notch of the thyroid cartilage, the cricoid and the upper rings of the trachea. Posteriorly the vertebral prominens which may be the spinous process of C7 or T1 marks the lower end of the neck and the upper end of the thoracic spine. Lymph nodes can be palpated at the anterior border of the sternocleidomastoid if they are enlarged and the thyroid gland straddling the thyroid cartilage can also be palpated. The supra-clavicular fossa is normally a depressed area above the clavicle. It may be lost when a fracture of the clavicle has occurred due to a deformity of the displaced fracture and hemorrhage. The muscles of the neck can be palpated in the upright position, but they are less tense when the patient is in the supine position. Individual muscles including the trapezius and sternocleidomastoid may be palpated. (3) Tenderness is an extremely helpful finding in cervical disc disease. Two types of tenderness to palpation can be differentiated. One is diffuse, elicited by compression of the paravertebral muscles and found over a broad area of the posterolateral muscle masses. The second type of tenderness is more specific and in a lean subject particularly, may help to localize the level of the degenerated disc. This may be elicited by localized pressure over the intervertebral foramen and spinous processes. Compression in these areas will reproduce not only neck pain, but occasionally radicular pain of a type usually noted by

the patient. (1)

Palpate the paraspinal zone seeking tender points or trigger points in the muscles. Many cases of neck pain are caused by trigger points in the neck. The slope of the shoulder margin from the back is significant and one should look for evidence of a trapezius paralysis or for winging of the scapula. (4)

Range of motion of the neck is next evaluated. Normally the range of extension and flexion of the neck is 90 degrees. Clinically this is evidenced by the patient being able to touch the chin to the chest and the back of the head to the region of the first thoracic spinous process. Side to side or lateral bending is a little less than 90 degrees in combination. Rotation of the head laterally to either side is approximately 60 degrees. The sequence of neck flexion is important. Less total flexion occurs if the neck first, then the chin is flexed (nod). If the chin is flexed first followed by neck flexion there is greater total flexion. (5)

Miscellaneous tests such as compression-extension of the cervical spine and distraction-flexion may be carried out. When the cervical neural foramina are narrowed as in osteoarthritis of the facet joints associated with cervical disc degeneration, compression of the cervical spine may reproduce or exacerbate pain in the upper extremity (compression extension). The diameters of the cervical spine may be increased by distracting the cervical spine as in using traction. Distraction can be accomplished by cupping the patient's chin and occiput with each hand of the examiner. This may relieve muscle spasm in the neck and diminish referred pain in the upper extremities. Gentle flexion of the cervical spine may also increase the diameter of the cervical foramina. (3,5) Turning the head to the affected side not only narrows the cervical canal, but the narrowing is caused by the dural action rather than bony narrowing. The dura attached to the skull twists on itself and shutters close the center as does a picture camera diaphragm in the lens opening. (5) What this does in essence, associated with downward pressure on the head, is to differentiate between scapular type referred pain as in the scapulocostal syndrome where the pain is almost always worse when the patient turns their head away from the side of the lesion from pain of cervical radiculopathy which is almost always worse when the head is turned toward the side of the lesion. In addition if the head is turned toward the side of the lesion and extended and downward pressure applied, this maneuver known and Spurling's maneuver in the older literature may also produce radicular pain. Valsalva's maneuver performed by having the patient holding his breath and forcing down against the closed glottis (as in moving the bowels) may reproduce the pain.

The neurological examination is now performed. In the cervical region it is extremely important not to omit examination of the lower extremities. Their assessment will have begun with the observation of gait, but deep tendon reflexes, motor power, tone of the extremities, atrophy and abnormal reflexes should be assessed. It is very important to do both position and vibration sense accurately as they are long tract signs from the posterior column often early involved in cervical spondylosis causing myelopathy.

Evaluation now devolves to local levels of the cervical spine. These are ascertained by motor reflex and sensory testing. The motor reflex and sensory testing is contained in standard textbooks and a brief and necessarily incomplete table is given.

C5 NERVE ROOT (C4-C5 Disc) Pain-neck, tip of shoulder, anterior arm Sensory Change-deltoid area Motor Change-deltoid, biceps Reflex Change-biceps

C6 NERVE ROOT (C5-C6 Disc) Pain-neck, shoulder, medial border of scapula, lateral arm, dorsum forearm Sensory Change-thumb and index finger Motor Change-biceps Reflex Change-biceps

C7 NERVE ROOT (C6-C7 Disc) Pain-neck, shoulder, medial border of scapula, lateral arm, dorsum forearm Sensory Change-index and middle finger Motor Change-triceps Reflex Change-triceps

C8 NERVE ROOT (C7-T1 Disc) Pain-neck, medial border of scapula, medial aspect of arm and forearm Sensory Change-ring and little finger Motor Change-intrinsic muscles of hand Reflex Change-none

Attention now must be turned to the shoulder girdle, especially the scapula where musculoskeletal conditions and nerve entrapment such as the suprascapular nerve entrapment and the musculoskeletal syndrome, the scapulocostal syndrome can refer pain up to the neck region. Therefore all movements of the shoulder and scapula must be evaluated. In particular, the levator scapula muscle should be exposed by cross-adducting the arm or internally rotating and extending it simultaneously. This will allow for palpation and possible reproduction of pain.

Finally, it should be mentioned in passing that there is school of thought that cervical pain (as well as lumbar pain) is a result of dysfunction of the joints of the cervical spine. There is further a school of thought which holds that examination of the patient should include evaluation of joint play in the cervical spine. This includes long axis extension, anterior posterior glide, side glide, and occipito-atlantal rock and rotation. The reader is referred to Mennell for further details. (6)

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PHYSICAL EXAMINATION OF THE

SHOULDER

Physical examination of the shoulder consists of inspection, bony palpation, soft tissue palpation, range of motion, neurological examination and special tests, and examination of related areas. It should not be forgotten also that numerous internal viscera, as well as the cervical spine and elbow can refer pain to the shoulder. Examination of the lungs, heart, diaphragm, gallbladder, and spleen should be considered in any case in which the pain remains undetected by simple physical examination.

Inspection should start with the patient suitably undressed with a general view of the thorax, the spine, and the shoulder girdle. At this point the contour of the shoulder girdle and muscle development or atrophy should be considered. Comparing one side of the body with the other (3) is important to see whether or not the scapulae are positioned symmetrically on the torso and whether there are obvious contractures, muscle tears, or step-offs. Swelling or depression around the acromioclavicular or sternoclavicular joints should be sought. It is important to note the motions of the shoulder and to see whether or not they are smooth or distorted. Bony palpation should take in the suprasternal notch and sternoclavicular joint, the clavicle, the coracoid process, the acromioclavicular articulation, the anterior aspect of the acromion, the bony dorsum of the acromion, the greater tuberosity of the humerus, the bicipital groove and the lesser tuberosity. It should be remembered that the bicipital groove is a normally tender area.

The posterior structure of the shoulder should also be noted, especially the superior medial angle on the medial border of the scapula. This area is very tender in the scapulocostal syndrome. When the levator scapular muscle is exposed. The lateral borders, as well as the vertebral borders of both scapulae should be palpated.

Next, soft tissue palpation should be done in the area of the supraspinatus, infraspinatus, and teres minor muscle. Following this the rotator cuff should be palpated as well as portions of the subacromial and subdeltoid bursa. The rotator cuff (1) lies directly below the acromion and must be rotated out from underneath before it can be palpated. The axilla should be inspected for lymph nodes, the brachial artery, and the latissimus dorsi. The anterior wall of the axilla is formed by the pectoralis major muscle. The sternocleidomastoid muscle should be palpated simultaneously. The costochondral junction should also be palpated.

The biceps should be palpated and the tendon of the long head of the biceps and anterior and middle portion of the deltoids examined as well as the posterior deltoid.

The range of motion of the shoulder is next inspected. References to various sources (1,2,3) will reveal different ranges of motion by different authors. In general abduction is given as 180 degrees with 2:1 ratio of the glenohumeral/scapulothoracic articulation. This changes obviously in the frozen shoulder syndrome. While abduction is 180 degrees, adduction is 45 degrees. Flexion is 90 degrees and extension 45 degrees. Internal rotation 55 degrees, and external rotation 40 to 45 degrees.

Examination of the musculature should seek winging of the scapula. With the arms in front of the patient and the patient pressing against a fixed object, the scapula may wing. When the winging is

from serratus anterior weakness, the scapula is displaced inward and upward and the inferior angle of the scapula approaches the spine. Contrary-wise in trapezius paralysis the weakness is most marked on raising the arms overhead and it causes the scapula to be displaced downward and outward.

Muscles of the shoulder girdle should then be checked. The primary extensors of the shoulders are the latissimus dorsi, teres major, and posterior portion of the deltoid, the secondary being the teres minor and triceps. The primary abductors are the middle portion of the deltoid and the supraspinatus and the secondary abductors are the anterior and posterior portions of the deltoid and the serratus anterior. The primary adductors are the pectoralis major and latissimus dorsi with the secondary adductors, the teres major, and anterior portion of the deltoid. External rotation is primarily carried out by the infraspinatus and teres minor and secondarily by the posterior portion of the deltoid. Internal rotation is primarily carried out by the subscapular, pectoralis major, latissimus dorsi, and teres major muscles with secondary internal rotation by the anterior portion of the deltoid. Scapula elevation is primarily carried out by the trapezii and levator scapula, and secondarily by the rhomboid major and minor. Scapular retraction is primarily by the rhomboids and secondarily by the trapezii and scapular protraction primarily by the serratus anterior.

Reflex testing for the shoulder should include biceps and triceps reflexes as pain may be referred from the neck; sensory testing should also be carried out.

Special tests (1) consist of the Yergerson test for long head of the biceps tendon stability, the drop arm test for rotator cuff tear, and the apprehension test for shoulder dislocation (1).

The scapulocostal syndrome may be discerned by maneuvers already alluded to above. This includes secondary tenderness or trigger points in the trapezius, rhomboid, and levator scapular muscles. The arm is extended and internally rotated or adducted so that the scapula is deviated away from the chest wall.

The thoracic outlet syndrome is tested by the modified Adson's test, the costoclavicular maneuver, and a hyperabduction syndrome test (3).

Various tests for impingement (2) include the impingement test where the patient's arm is forcefully elevated through forward flexion by the examiner causing a jamming of the greater tuberosity against the anteroinferior acromial surface, the Hawkins-Kennedy impingement test in which the examiner forward flexes the arm to 90 degrees and then forcibly internally rotates the shoulder. Additionally the Gilchrist sign in which the patient lifts a 2 to 3 kilogram weight over the head, externally rotating the arm fully and lowered to the side. The Lippman test which is similar and Heuter's sign should be performed.

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Publishers, Inc., Chicago, London, 1987.

EXAMINATION OF THE LOW BACK

Physical examination of the low back should take into account that pain must always be regarded as a symptom, and not a disease, and every attempt be made to determine its etiology. Possible causes of low back pain include involvement of skeletal, muscular and related structures, neurological structures, pelvic or abdominal disease, postural abnormality and psychogenic factors (1).

The examination can roughly be divided into four parts:

1)The general examination of the abdomen and pelvic organs as specialized parts of the general physical examination. 2)Neurological examination of the lower extremities with special reference to motor power, deep tendon reflexes, sensation and autonomic changes. 3)The biomechanical and physical examination of the back itself. 4)The assessment of the psychological and emotional state of the patient.

A further decision to be made is the employment of various specialized and purported tests, such as joint play and trigger point and biomechanical evaluation (2,3).

The physical examination starts with the history and this can be used as an assessment of the patient's psychological state. Any bizarre claims, secondary gain, or other psychological factors which are obvious should be noted. A plea has been made by many for routine use of the MMPI in patients with low back disease.

The patient should have a complete general physical examination to include rectal and pelvic examination. The abdomen should also be carefully palpated, auscultated and the peripheral pulses also palpated. Any discolorations of the lower extremities suspicious skin markings on the back, hair tufts or birth marks as well as lipomas should be carefully noted. Any signs of atrophy of muscle or hair loss in the back or lower extremities should be considered. A careful inspection of the back should be made to see if the extremities are equal in length and whether or not the shoulders and pelvis are horizontal. It should also be noted whether or not muscle spasm is present with an obvious list to one side, and whether the normal contours of the lumbar spine are noted. Further a finding of scoliosis may be noted. This can be related to a shortened extremity or muscle spasm of the back muscles. As a corollary, one should examine the chest for Kyphosis as well as chest excursion to rule out diseases such as Scheuermann's. Examination of the range of motion of the back should be noted. Normally there is 80 degrees of flexion of the back, 25 degrees of extension as well as 25 degrees of rotation to the right and left as well as lateral tilting although obviously some of the tilting and rotation come from the thoracic spine.

The lumbar pelvic rhythm should be observed. The exact moment of pain or discomfort if present should be noted. Some degree of hyperextension should be attempted to see whether or not pain is produced in this position. A finding of spasm of the paraspinal muscles can occasionally be found in volitional muscle guarding rather than involuntary reflex guarding. This volitional paravertebral spasm will disappear if the patient is instructed to shift his weight from one foot to another and back again. It is possible to simulate muscle spasm unilaterally by voluntary

contraction of the latissimus dorsi muscle, but if the patient is forced to keep that foot off the floor, the spasm will disappear. If the patient stoops with ease but complains of pain on regaining the upright position, the possibility of "flat back strain" is suggested.

Gait is observed and this may reveal that the trunk is bent forward and also tilted to one side. Lesions involving a lumbar disc may produce steps that are taken slowly and deliberately with the affected foot placed on the floor gently. The painful leg may be held flexed at the hip and the knee, and the foot is plantar flexed with the heel never being lowered to the floor so as to avoid dorsiflexion.

The position of the patient sitting should now be tested. The patient should be checked to be sure that he sits equally on both buttocks. With the hands crossed behind the neck, upright rotation to the right and left is performed. If there is a limitation of upright rotation, sacro-iliac joint pathology on the side to which the patient is turned is suggested. Most rotation is performed in the thoracic spine. If the patient lies with his legs dangling from the side of the table his body line supported by the examiner, there is a strain on the lumbosacral junction. The patient is then rotated passively through the trunk to the right and left. This exerts a backward torsion on the sacro-iliac joint on the side toward which rotation is directed. The patient's other sacro-iliac joint can then be pressed downward over the anterior spine causing a marked backward torsion on the sacro-iliac joint of the side stressed. In the seated position the distance between the posterior-superior iliac spine should be measured. This distance increases when the patient lies prone normally and if not, is a sign of ankylosing spondylitis.

With the patient seated, a modified straight leg raising test sometimes called the sitting root test or sciatic flip test is done so as to extend the knee to the point of resistance, and then place one hand behind the head over the occipital region and sharply flex the cervical spine. As the patient is sitting on some pretext the legs should be extended in front of the patient so that they are 90 degrees to the trunk. This is an occult form of straight leg raising and in "knowledgeable patients" may be used to obviate subjective complaints of pain in the supine straight leg raising test.

The patient is then placed supine. In the straight leg raising test (first described by Forst), the leg is flexed at the hip with the knee held in full extension. The ankle during this test remains in relaxed position. During straight leg raising, the first 15-30 degrees in elevation causes no movement of the nerve root at the foraminal level, but when the leg has reached an angle of 30 degrees there is traction on the sciatic nerve followed by downward movement of the roots in their foramina. The greatest degree of movement occurs in the L5 roots, some slight movement at L4, and essentially no movement above. The greatest distance of any movement 2.5 cm occurs when straight leg raising has brought the leg to an angle of 60-80 degrees. Leg raising may be limited or painful because of tight hamstring muscles, sacro-iliac joint pathology and radiculitis. If on the straight leg raising test when there is production of pain, the leg is then dropped one-half to one inch then the stress on the sacro-iliac joint which occurs from rotation backward on the sacrum by the pull of the hamstring on the origin at the ischial tuberosity is removed. Exacerbation of pain on dorsiflexion of the foot is the true Lasegue's sign. Both legs can now be raised together keeping the knees extended. In this movement, the hamstring muscles pull equally on their origins on both sides, tilting the pelvis backward as a whole at the lumbo-sacral junction. This tilting tends to occur at an earlier angle of elevation than that in which sacro-iliac joint motion takes place; hence pain at an earlier angle with both legs raised together than with either leg raised by itself, almost certainly indicates lumbo-sacral joint dysfunction. A very important

point is the fact that straight leg raising in an acute herniated disc because of lumbar irritation should not commence at an angle lower than 30-35 degrees and any activation at a smaller angle than that should arouse concern (2).

Numerous modifications of Lasegue's sign have been described (4). If the test is carried out with the thigh and leg in a position of abduction and internal rotation it is known as Bonnet's phenomenon; with dorsiflexion of the foot (Bragard's sign) or of the great toe (Scicard's sign). Sometimes the pain is brought on while the patient is supine with his thighs and legs extended merely by dorsiflexion of the foot or great toe. This aggravation of pain by passive dorsiflexion of the foot is sometimes called Gower's sign. Numerous other modifications including O'Connell's test and the posterior tibial nerve sign may be found (4) and familiarity with a few of these is obviously preferable than an encyclopedic novel.

Two further signs however are relatively unique and should be considered. The first is Patrick's sign, sometimes also known by the acronym fabere sign. Pain is produced in the hip when the heel or the external malleolus of the painful extremity is placed on the opposite knee and the foot and thigh is pressed downward. This movement comprises simultaneous flexion, abduction, external rotation and extension of the involved hip hence the acronym, fabere sign. Hip disease usually involves some radiation of pain into the groin. The movements of the hip can also be tested with the knee and leg extended by internal and external rotation which involves only hip movement and no other movement.

A variety of signs have been described including side bending of the pelvis by Mennell (5).

In evaluating the mechanics of the spine and extremities and especially their tightness, the sign of Ober for iliotibial band resiliency and tightness of the tensor fasciae latae should be checked.

In the prone position the distances between the posterior superior spines is now measured. It should be greater than in the seated or upright position. If not, it may be indicative of ankylosing spondylitis. Then skin rolling is performed by a smooth rolling of the skin over the spinous processes over the vertebra. Then a direct vertical thrust is performed by flexing the forefinger and placing the horizontal middle phalanx on one side of the process and the hyperextended distal phalanx of the thumb on the other. This may also be checked by hyperextending the lumbar spine by lifting the legs (5).

One of the most useful things is to know the underlying anatomy. The reference point palpated is the posterior superior iliac spine which is usually, except in the most obese individuals, perceptible as a dimple. One fingerbreadth medial is the most superficial posterior ligament of the sacro-iliac joint. One fingerbreadth lateral is the origin of the small portion of the gluteal muscle. One fingerbreadth above the posterior iliac spine is where the sacrospinatus muscle joins its tendon. One fingerbreadth above and medial to the posterior superior iliac spine is the area over the intralaminar facet joint. One fingerbreadth medial and inferior to the intralaminar facet joint is the disc.

Tenderness lateral to the ischial tuberosity where the sciatic trunk emerges from beneath the piriformis muscle suggests either tightness of the muscle or radicular pathology. Tenderness on rolling the fingers could be over the sciatic nerve trunk in the back of the thigh indicating irritation of the sciatic nerve. Tenderness over the trochanter of the femur suggests trochanteric

bursitis (5).

Assessment of the mechanics of the spine, pelvis and supporting structures may be evaluated under the method of Dr Hans Kraus (6). This consists of checking upper and lower abdominal strength as well as upper and lower back extensor strength as well as the angle of pelvic tilt.

Perhaps the simplest test that can be performed is the neurologic examination. Motor power for each specific lumbar segment is tested. These are found in all standard neurologic texts (4), and no substitute for memorization really exists. In general however, the flexors of the thigh are L1-2, the extensors of the knee L3-4, the dorsiflexors of the ankle L4-5, the plantar flexors of the ankle L5 and S1, and the extensors of the hip also L5 and S1. The deep tendon reflexes consist of the patellar reflex which is generally L3 and L4, and the ankle reflex generally S1 and S2. While the very important L5 root would not seem to have any reflex representation, on occasion a posterior tibial reflex can be obtained (4), giving some indication if it is unilaterally absent of L5 dysfunction.

Sensory examination should be carried out both for hyperesthesia and hypesthesia. It should be recalled that if there are two types of pain i.e., sharp or epicritic pain, that this usually represents a dermatopic radicular or neurological distribution while an aching, deep, more poorly defined pain represents protopathic and oftentimes scleratogenous pain. Therefore the descriptive locations of these pains should be included as well as signs of position or vibration sense, pinprick and touch.

Two further tests should be performed. One is Baker's test in which the patient kneels on a straight chair so that he lowers his chest to the chair itself. Even in a patient with an acute herniated disc this should be possible, and this like Hoover's sign (9) may detect malingering. Finally Yeoman's sign is an important sign of acute lumbosacral strain. In this test the patient is prone. The opposite side of the pelvis is stabilized by the examiner's left hand and the knee is lifted toward the ceiling by the examiner's right hand. In a patient whose back can be hyperextended, this may be a valuable sign of an acute lumbosacral strain. Waddell's five signs of symptom magnification should be sought. (7) A Table of Waddell's signs is appended.

Finally percussion and palpation of the lumbosacral spine should be carried out.

COMPARISON OF SYMPTOMS AND SIGNS OF PHYSICAL DISEASE AND ABNORMAL ILLNESS BEHAVIOR IN LOW BACK PAIN

Waddell, et al Br. Med J. 289:740 1984

TABLE I:

SYMPTOMS PHYSICAL DISEASE MAGNIFIED

Pain	Localized whole leg, tailbone pain	Numbness	Dermatomal whole leg numbness	Weakness
Myotomal	whole leg gives way	Time Pattern	Varies with time never free of pain	Response to treatment
Variable benefit	Intolerant of prescription,	emergency admissions		

SIGNS

Tenderness	Localized	Superficial, widespread, non-anatomical	Axial loading	No lumbar pain
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Lumbar pain Simulated rotation No lumbar pain Lumbar pain Straight leg raising Limited on distraction Improves with distraction Sensory Dermatomal Regional Motor Myotomal Regional, give-away General response Appropriate pain Over-reaction

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PHYSICAL EXAMINATION OF THE HIP

Physical examination of the hip and pelvis consists of observation of gait, inspection, bony palpation, soft tissue palpation, range of motion, neurologic examination, special tests, and examination of related areas. (1,2,3)

GAIT: Physical examination is most conveniently done by observing the patient's gait as he walks into the examining room. A limp, deformity or leg length discrepancy may immediately present itself. Gait is divided into two phases; the stance phase during which time the foot is in contact with the ground and the swing phase when the opposite foot is in contact with the ground.

The first element of gait is pelvic rotation which serves to flatten the arch of the center of the mass as it moves through space. The second determinate is pelvic list. The third is the stance phase/knee flexion, and the final determinant is lateral displacement of the body. With familiarity with the normal, certain types of gaits can be detected.

A gluteus medius or abductor gait is seen in patients with weakness of the gluteus medius.

Because of the weakness of the hip abductors, normal pelvic list is exaggerated. The antalgic gait is seen very often in painful conditions about the hip and the pain is experienced during the stance phase, so the patient tries to shorten the stance phase as much as possible and will shorten the time of stance on the involved hip.

INSPECTION AND PALPATION: From the posterior aspect, (1) posterior superior iliac spines, greater trochanter of the hip, ischial tuberosity, and the sacroiliac joint are inspected and palpated. Any evidence of pelvic obliquity should be noticed as a clue to leg length, discrepancy, or contracture of the hip. The presence of angular deformity of the limbs should be noted.

From the anterior aspect, bony inspection and palpation should occur over the anterior superior iliac spines, iliac crest, iliac tubercle, greater trochanter, and pubic tubercles. (1)

Soft tissue palpation should include the femoral triangle, including the inguinal ligament, femoral artery, nerve, and vein, as well as the sartorius and adductor longus muscle. Then the greater trochanter of the hip should be palpated to eliminate trochanteric bursitis. The gluteus medius muscle should be inspected for the snapping hip syndrome which occurs occasionally when the hip is flexed, adducted, and bearing weight. The snap usually occurs in activity such as climbing or walking up stairs. The sciatic nerve should be palpated as should the iliac crest and cluneal nerves. The hip and pelvic muscles should also be palpated.

Range of motion measurements should be carried out. There are several quick tests to determine range of motion. This includes abduction, adduction-flexion, flexion and adduction, flexion-abduction, and external rotation, external rotation and internal, and external rotation. (1,3)

Passive range of motion should be tested by the Thomas test for flexion 120 degrees, extension 30 degrees, abduction 45 to 50 degrees, and adduction 20 to 30 degrees, internal rotation 35 degrees, and external rotation 45 degrees.

The neurologic exam should be carried out and is divided into muscle testing as well as sensory testing. The primary flexors of the hip is the iliopsoas, and the secondary flexor the rectus femoris. The primary extensors are the gluteus maximus and a secondary extensor, the hamstrings. The abductors are primarily the gluteus medius, with a secondary the gluteus minimus, and the primary adductors, the adductor longus, with a secondary adductor, the adductor brevis, magnus, pectineus, and gracilis.

Sensation should be derived from standard sensory dermatopic and nerve maps.

SPECIAL TESTS: The Trendelenburg test, (2,3) is designed to evaluate the strength of the gluteus medius. After observing the normal posterior superior iliac spine dimples, the patient is then asked to stand on one leg. If he stands erect, the gluteus medius on the supported side should contract as soon as the leg leaves the ground and should elevate the pelvis on the unsupported side. If the pelvis on the unsupported side remains in position or actually descends, the gluteus medius is either weak or non-functioning.

Leg length discrepancies should be evaluated. True leg length discrepancy can be determined with the patient supine on an examining table when the distance between the anterior iliac spine and the medial malleolus of the ipsilateral ankle is measured. The apparent leg length discrepancy seen in pathological conditions of the hip may be determined by actual measurement. The

apparent shortening may stem from adduction or abduction, or flexion deformities of the hip or fixed pelvic obliquity. The reference is taken in the midline using the umbilicus and the distance measured to a fixed bony landmark, usually the medial malleolus. (3) If there is an apparent leg length discrepancy with no difference in true leg length, then one may conclude there is a fixed deformity of the hip.

An important test is Ober's test for contraction of the iliotibial band. With the patient lying on his side with his involved leg uppermost, the leg is abducted as far as possible and the knee flexed to 90 degrees while keeping the hip joint in the neutral position to relax the iliotibial tract. The abducted leg is then released. If the iliotibial tract is normal, the thigh should drop to the adducted position.

The Thomas test for flexion contracture consists of examining the patient supine on the examining table with the pelvis level and square to the trunk. The pelvis is stabilized by placing the hand on the patient's lumbar spine and flexing his hip, bringing his thigh up onto his trunk. As you flex the hip, notice at what point his back touches your hand.

Numerous tests for tightness have been described. (2) These include the rectus femoris contracture test, Ely's test, the abduction contracture test, the adduction contracture test, the piriformis test, the hamstring test, and the tripod sign, as well as the straight leg raising test.

Patrick's or Faber's sign should also be carried out. Tests for congenital dislocation of the hip include the Ortolani click, telescoping or adduction contracture. (1) These are beyond the scope of the present exam.

In examination of related areas, the coccyx and sacrococcygeal joint may be examined on rectal examination. It should be remembered that most often primary hip pain is perceived as inguinal pain and symptoms of pain in the hip's posterior aspect are usually referred from the lumbar spine, but in some instances pain may be referred to the hip from the knee so the knee needs to be examined also.

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PHYSICAL EXAMINATION OF THE KNEE

Physical examination of the knee (1,2,3) consists of inspection, bony palpation, soft tissue

palpation, tests for joint stability, range of motion, neurologic testing, and special tests.

Inspection begins with general examination and gait. Foot alignment is noted and further it is noted if the heel is in neutral or whether there is calcaneal valgus or varus positions which alter the forces on the knee. The overall alignment of the leg should be noted. Ordinarily there is about 7 degrees of knee valgus. The gait pattern should be ascertained as being normal or pathologic. The presence of lateral or medial thrust should be noted. The patient should be asked to perform a deep knee bend. A full squat may induce the pain associated with a torn meniscus and pain will occur at the deepest portion of the squat whereas pain of patella origin often will be noted as the patient arises from a squatting position as the quadriceps is maximally contracted.

After the patient is asked to sit on the examining table, he should lie first supine and then prone. Any differences in leg swelling should be noted. The presence of a popliteal cyst or other abnormality in the popliteal space can only be found in the prone position. Localized swelling over the patella may represent a prepatella bursitis or an infected patella bursa. Any swelling over the tibial tubercle may indicate Osgood-Schlatter's disease. Medial and in particular lateral prominence should be sought visually and by palpation as cystic degeneration of the menisci may present as a cyst of varying size, at or near the joint line. Diffuse swelling about the knee implies an effusion that can easily be proven by ballotment of the patella or noting of a fluid wave. The tightness of the hamstrings should be noted. The neuro-circulatory component of a knee examination is critical. The hips should be routinely examined.

Bony palpation should include on the medial aspect, the medial tibial plateau, the tibial tubercle, the medial femoral condyle, and the adductor tubercle. On the lateral aspect, the lateral tibial plateau, lateral tubercle, lateral femoral condyle, lateral femoral epicondyle, and the head of the fibula should be palpated. In the trochlear groove and the patella palpation should also be carried out.

There should also be palpation and measurement of the quadriceps and inspection of the infrapatella tendon and the clinically significant bursae of the knee which includes the prepatella bursa, the superficial infrapatella bursa, the deep infrapatella bursa, and the pes anserine bursa.

In the medial aspect of the knee, the medial meniscus, medial collateral ligament, sartorius, gracilis, and semitendinosus palpation should be carried out. In the posterior aspect, the popliteal fossa, posterior tibial nerve, popliteal vein, and popliteal artery, as well as the gastroc should be inspected.

Tests for joint motion should be carried out after tests for joint stability. Tests for joint stability include the menisci and cruciate ligaments. Range of motion should be carried out both active and passive. Passive range of motion includes flexion to 135 degrees, extension 0 degrees, external and internal rotation of 10 degrees.

The neurologic exam should include muscle testing with the primary extensor being the quadriceps, the primary flexors the hamstrings, then sensory testing, and testing of the reflexes carried out.

Special tests include the McMurray test where during knee flexion and extension, a torn meniscus may produce a palpable audible "clicking" in the region of the joint line. This suggests the

possibility of a torn meniscus.

Apley's compression and distraction tests is another procedure done with the patient lying prone on the examining table with one flexed to 90 degrees. It is again a test for meniscal tear. The distraction test helps differentiate between meniscal and ligamentous problems of the knee joint. Knee joint effusion tests should also be carried out.

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PHYSICAL EXAMINATION OF THE FOOT AND ANKLE

Physical examination of the foot and ankle includes inspection, bony palpation, soft tissue palpation, tests for ankle joint stability, and range of motion, the neurologic examination consisting of muscle testing, sensation, and reflex testing, special tests, evaluation of the skin, vascular status, and nails. (1,2,3) It should also concern itself with a search for general neurologic, rheumatological and systemic disorders. Reflex sympathetic dystrophy should be considered.

An important aspect of the examination of the foot is the division into the foot as a structural entity and localized structures within the foot such as the toenails.

Examination of the foot begins interestingly enough with the shoes. The patient should be requested to bring footwear that he customarily wears. Deformities of the shoes may indicate where the problem area is. For example, a pronated flat foot wears down the medial border of the sole more than the lateral, and toe deformities such as hallux valgus and hammertoes leave telltale marks on the vamp. Heel valgus and varus may distort the counter of the shoe.

On inspecting the foot the patient should be asked to indicate the site of pain. Certain typical sites of pain suggest the diagnosis such as those seen in corns, bunions, and Seever's osteochondritis on the dorsum, or hammertoe accessory navicular, and calcaneal bursitis on the lateral, and digital neuroma, foot strain, and sub-calcaneal bursitis on the sole.

The two feet should be examined dangling from a chair at a convenient height and the two sides compared for obvious deformities, fractures, sprains, or arthritides. Localized soft tissue masses and bony overgrowths may be evident.

Obvious deformities of the toes and nails should be sought. The big toe may be directed laterally as in the hallux valgus deformity and may under-ride or override the second toe. Lesser toes may

show flexor deformity at the distal interphalangeal joint (mallet toe), proximal interphalangeal joint (hammertoe), or both joints with dorsal subluxation (claw toe). (3)

Bony palpation should next be carried out which includes the head of the first metatarsal bone and metatarsal phalangeal joint, the first metatarsal cuneiform, the navicular tubercle, and the head of the talus, as well as the medial malleolus and other structures on the medial aspect. On the lateral aspect, the fifth metatarsal bone and metatarsal phalangeal joint, the calcaneus, peroneal tubercle, and lateral malleolus should be palpated for sites of pain.

The dome of the talus should also be palpated as should the inferior tibiofibular joint. In the hind foot the dome of the calcaneus and the medial tubercle should be palpated. On the plantar surface sesamoid bones should be palpated. The height of the arch of the foot should be assessed for a pes planus or pes cavus deformity. (1)

Soft tissue palpation then should be carried out including the head of the metatarsal phalangeal joint for gout, the hallux valgus with bunion formation, the tibialis posterior and spring ligament.

Palpate the medial malleolus including the deltoid ligament and important structures about the medial malleolus including: 1) the tibialis posterior tendon, 2) the flexor digitorum longus tendon, 3) the posterior tibial artery and tibial nerves, and 4) the flexor hallucis longus tendon. At the time the posterior tibial artery may be palpated as well as the dorsal pedal artery. In checking for a tarsal tunnel syndrome (4) marked tenderness may be elicited at the entrapment point of the plantar nerves. This is at the base of the medial longitudinal arch near the anterior portion of the calcaneus. In an adult the point is one finger breadth below and three finger breadths anterior the medial malleolus. Pressure here should cause radiation to the anterior portion of the foot.

The sole of the foot should be palpated for a Morton's neuroma between the third and fourth interdigital webs, but neuromas at other interspaces are not unknown.

On the dorsum of the foot between the malleoli are the three important tendons and the dorsal pedal artery. The three tendons are the tibialis anterior, extensor hallucis longus, and extensor digitorum longus tendons.

In and about the lateral malleolus are the anterior talofibular ligament, the calcaneofibular ligament and the posterior talofibular ligament.

The head of the fifth metatarsal should be palpated since there is a bursa there subject to inflammation.

The calcaneus should next be inspected including the retrocalcaneal bursa and calcaneal bursa. The gastrocnemius and soleus muscles join to form the Achilles tendon which inserts into the calcaneus. The Achilles tendon should be inspected.

Allusion has already been made to the plantar surface of the foot where the plantar aponeurosis should be palpated as should the broad medial tubercle of the calcaneus where a heel spur may exist causing tenderness and affecting the heel strike phase of gait. The plantar aponeurosis of fascia originate at the medial tuberosity of the calcaneus, splay out over the sole and insert into the ligamentous structures. These should be palpated and feel smooth, nontender, and non-nodular. Point tenderness may indicate plantar fasciitis while discrete palpable nodules indicate

Dupuytren's contractures. Most often nodules on the skin of the sole, particularly the ball of the foot are plantar warts which are more tender when pinched than when under direct pressure. Upon palpating the soft tissues between each of the metatarsal heads for tenderness and swelling, a Morton's neuroma may be found. Calluses on the plantar surface, unlike warts, are tender to pressure but not to pinching.

Inspection of the toes may reveal claw toes, hammertoes, or corns, as well as ingrown toenails.

Next test for ankle joint stability should be carried out including the anterior drawer sign. (1)

Range of motion should be carried out. It should consist of active and passive range of motion. The motions examined are: 1) ankle motion consisting of dorsiflexion and plantar flexion. 2) subtalar motion consisting of inversion and eversion. 3) mid-tarsal motion consisting of forefoot adduction and forefoot abduction and, 4) toe motion consisting of flexion and extension. Active range of motion tests can be carried out and there are several quick tests (1) to determine whether or not there is any gross restriction in a patient's range of motion. To test plantar flexion and toe motion, have the patient walk on his toes. To test dorsiflexion have him walk on his heels. To test inversion, have him walk on the lateral borders of his feet. To test eversion, instruct him to walk on the medial borders of his feet.

Passive range of motion consists of ankle dorsiflexion 20 degrees, ankle plantar flexion 50 degrees. Subtalar inversion 5 degrees, subtalar eversion 5 degrees, forefoot adduction 20 degrees, forefoot abduction 10 degrees. First metatarsal phalangeal joint, flexion 45 degrees, extension 70 to 90 degrees. The motion of the lesser toes show that normally individuals will flex their toes to grasp the ground or their shoes to gain extra stability. Active flexion takes place at the distal and proximal interphalangeal joints while extension normally takes place only the metatarsal phalangeal joints.

Neurologic examination should cover the dorsiflexors including the tibialis anterior, extensor hallucis longus, and extensor digitorum longus; the plantar flexors including the peroneus longus and brevis, the gastrocnemius and soleus, the flexor hallucis longus, the flexor digitorum longus, and the tibialis posterior.

Sensation tests should be carried out from the lower leg on down. The reflex test under consideration is the Achilles tendon reflex.

In a search for related complaints, Homans' sign for deep vein thrombophlebitis should be carried out. The foot in neurologic disorders (3) may show a pes cavus foot with claw toes. This may be seen in Charcot-Marie-Tooth disease and Friedreich's ataxia. The cerebral palsy patient may show equinovarus and varus or valgus deformities may develop in spastic hemiplegia.

The foot in systemic disorders may manifest themselves such as in the metatarsal phalangeal joint involvement of the great toe in gout. The bilateral symmetrical synovitis of multiple joints in the forefoot in rheumatoid arthritis, and in the seronegative spondyloarthropathies where there is involvement not only of the synovium but the fibrous joint capsule ligamentous insertions and the joint cartilage itself. A search for skin lesions may reveal psoriatic arthritis. In osteoarthritis the metatarsal phalangeal joint of the great toe is a common site. Multiple mid joint pathology should arouse suspicion of neuropathic involvement Charcot's joints.

Reflex sympathetic dystrophy may show vascular disturbances and trophic changes. There may be localized edema, muscle spasm and tenderness with hyperesthesia, dysesthesia, and allesthesia. The skin may be warm, dry, and red to begin with and later become cold, clammy, and cyanotic. As the disease increases the edema may become brawny, the joints thicken, and the muscles become wasted. Skin is atrophic, thin, and glazed. Nails are brittle and ridged, and the fat pads of the foot become atrophic and muscle waste away.

Finally, tumors of the feet including ganglia, melanomas and other soft tumors may be seen.

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