the patient stands with the palms facing forward.

Look for a joint effusion, which appears as a swelling on either side of the olecranon. Discrete swellings over the olecranon or over the proximal subcutaneous border of the ulna may be due to rheumatoid nodules, gouty tophi, an enlarged olecranon bursa or, rarely, to other types of nodules (Table 9.11).

Feel for tenderness, particularly over the lateral and medial epicondyles which may indicate tennis or golfer's elbow, respectively. Palpate any discrete swellings. Rheumatoid nodules are quite hard, may be tender and are attached to underlying structures. Gouty tophi have a firm feeling and often appear yellow under the skin, but are sometimes difficult to distinguish from rheumatoid nodules. A fluid collection in the olecranon bursa is softly fluctuant and may be tender if inflammation is present. These collections are associated with rheumatoid arthritis and gout, but often occur independently of these diseases.

Small amounts of fluid or synovitis of the elbow joint may be detected by the examiner, facing the patient, placing the thumb of the opposite hand along the edge of the ulnar shaft just distal to the olecranon where the synovium is closest to the surface. Full extension of the elbow joint will cause a palpable bulge in this area if fluid is present.

Move the elbow joints passively. The elbow is a hinge joint. The zero position is when the arm is fully extended (0 degrees). Normal flexion is possible to 150 degrees. Limitation of extension is an early sign of synovitis.

If lateral epicondylitis is suspected, ask the patient to extend the wrist actively against resistance (see Figure 9.70, page 291). Test the range of active movements by standing in front of the patient and demonstrating. If there is any deformity or complaint of numbness, a neurological examination of the hand and arm are indicated for ulnar nerve entrapment.

The shoulders

Examination anatomy (**Figure 9.25**)

The shoulder joint includes the clavicle, scapula and humerus. The acromioclavicular joint is formed by the acromion of the scapula and the clavicle. Movements of the shoulder are a result of a combination of ball-and-socket articulation at the glenohumeral joint (between the glenoid cavity of the scapula and the ball-shaped end of the humerus) and motion between the scapula and the thorax. It is the most mobile joint in the body. The joint is encased in a capsule and is lined with synovium.

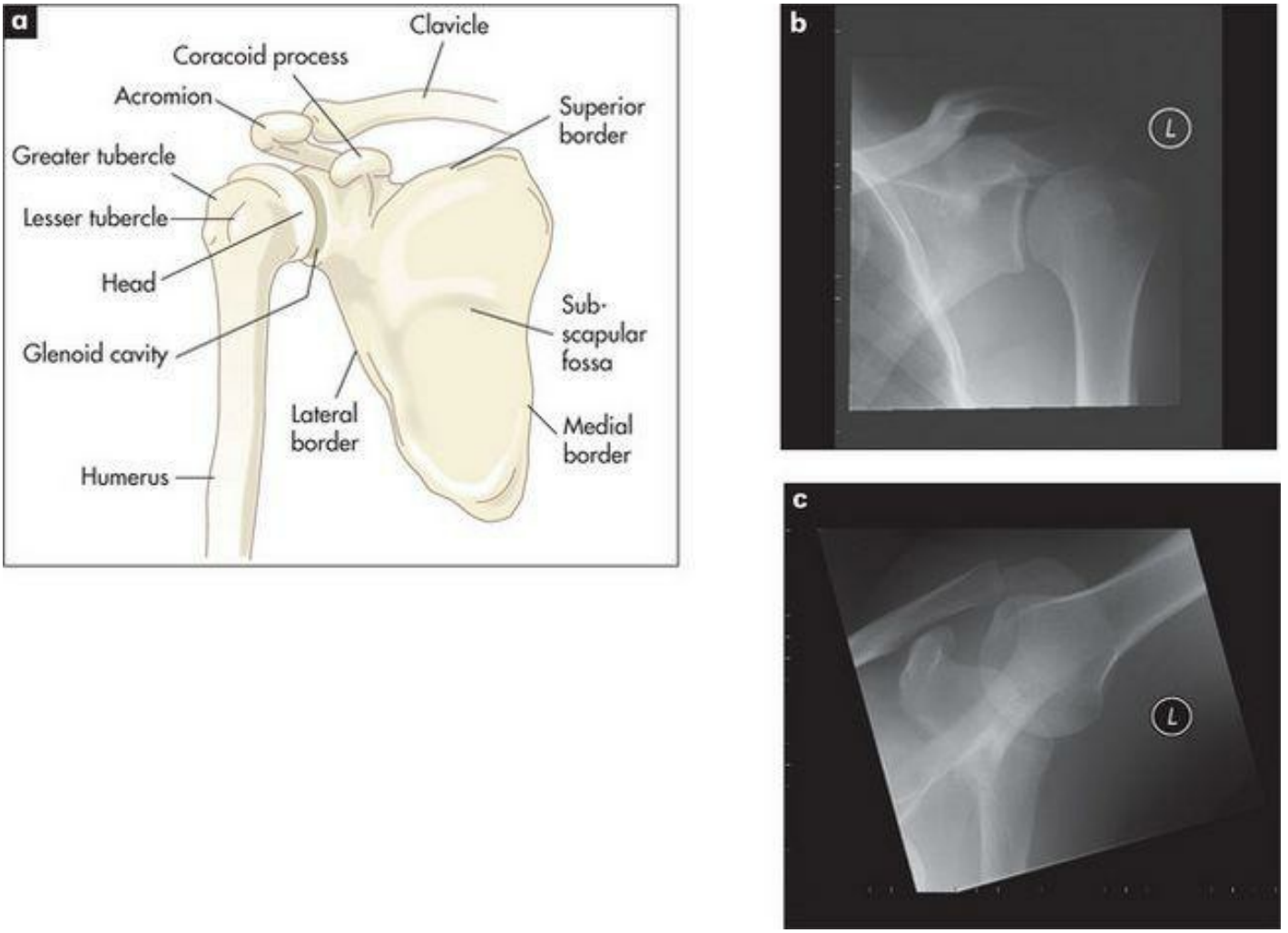


Figure 9.25 Examination of the shoulders
(a) Anatomy of the shoulder. (b) X-ray of left shoulder in the neutral position; the relative positions of the humeral head, clavicle and scapulae can be seen. (c) X-ray of left shoulder in abduction. Abduction of the arm rotates the head of the humerus and the clavicle moves upwards.

X-rays courtesy M Thomson, National Capital Diagnostic Imaging, Canberra.

This complicated joint is frequently affected by a number of non-arthritic conditions involving its bursa, capsule and surrounding tendons—e.g. 'frozen (stiff) shoulder' (adhesive capsulitis), tendinitis, bursitis. All of these disorders affect movement of the shoulder.

History

Pain is the most common symptom of a patient with shoulder problems.[5] Typically it is felt over the front and lateral part of the joint. It may radiate to the insertion of the deltoid or even further. Pain felt over the top of the

shoulder is more likely to come from the acromioclavicular joint or from the neck. *Deformity* has to be severe before it becomes obvious. *Pain and stiffness* may severely limit shoulder movement. *Instability* may cause the alarming feeling that the shoulder is jumping out of its socket. This is most likely to occur during abduction and external rotation (e.g. while attempting to serve a tennis ball). *Loss of function* may result in difficulty using the arms at above shoulder height or reaching around to the back.

Examination

Watch the patient undressing and note forward, backward and upward movements of the shoulders and whether these seem limited or cause the patient pain. Stand back and compare the two sides. The arms should be held at the same level and the outlines of the acromioclavicular joints should be the same. There may be wasting of one of the deltoid muscles that will not be obvious unless the two are compared.

Look at the joint. A swelling may be visible anteriorly, but unless effusions are large and the patient is thin these are difficult to detect. Look for asymmetry and for scars as a result of injury or previous surgery.

Feel for tenderness and swelling. Stand beside the patient, rest one hand on the shoulder and move the arm into different positions (see below). As the shoulder moves, feel the acromioclavicular joint and then move the hand along the clavicle to the sternoclavicular joint.

Move the joint (Figures 9.26 and 9.27). The zero position is with the arm hanging by the side of the body so that the palm faces forwards. *Abduction* tests glenohumeral abduction, which is normally possible to 90 degrees. For the right shoulder the examiner stands behind the patient resting the left hand on the patient's shoulder, while the right hand abducts the elbow from the shoulder. *Elevation* is usually possible to 180 degrees when it is performed actively, as movement of the scapula is then included. *Adduction* is possible to 50 degrees. The arm is carried forwards across the front of the chest. *External rotation* is possible to 65 degrees. With the elbow bent to 90 degrees the arm is turned laterally as far as possible. *Internal rotation* is usually possible to 90 degrees. It is tested actively by asking the patient to place his or her hand behind the back and then to try to scratch the back as high up as possible with the thumb. Patients with rotator cuff problems complain of pain when they perform this manoeuvre. *Flexion* is possible to 180 degrees, of which the glenohumeral joint contributes about 90 degrees. *Extension* is possible to 65 degrees. The arm is swung backwards as in marching. During all these manoeuvres, limitation with or without pain and joint crepitus are assessed.

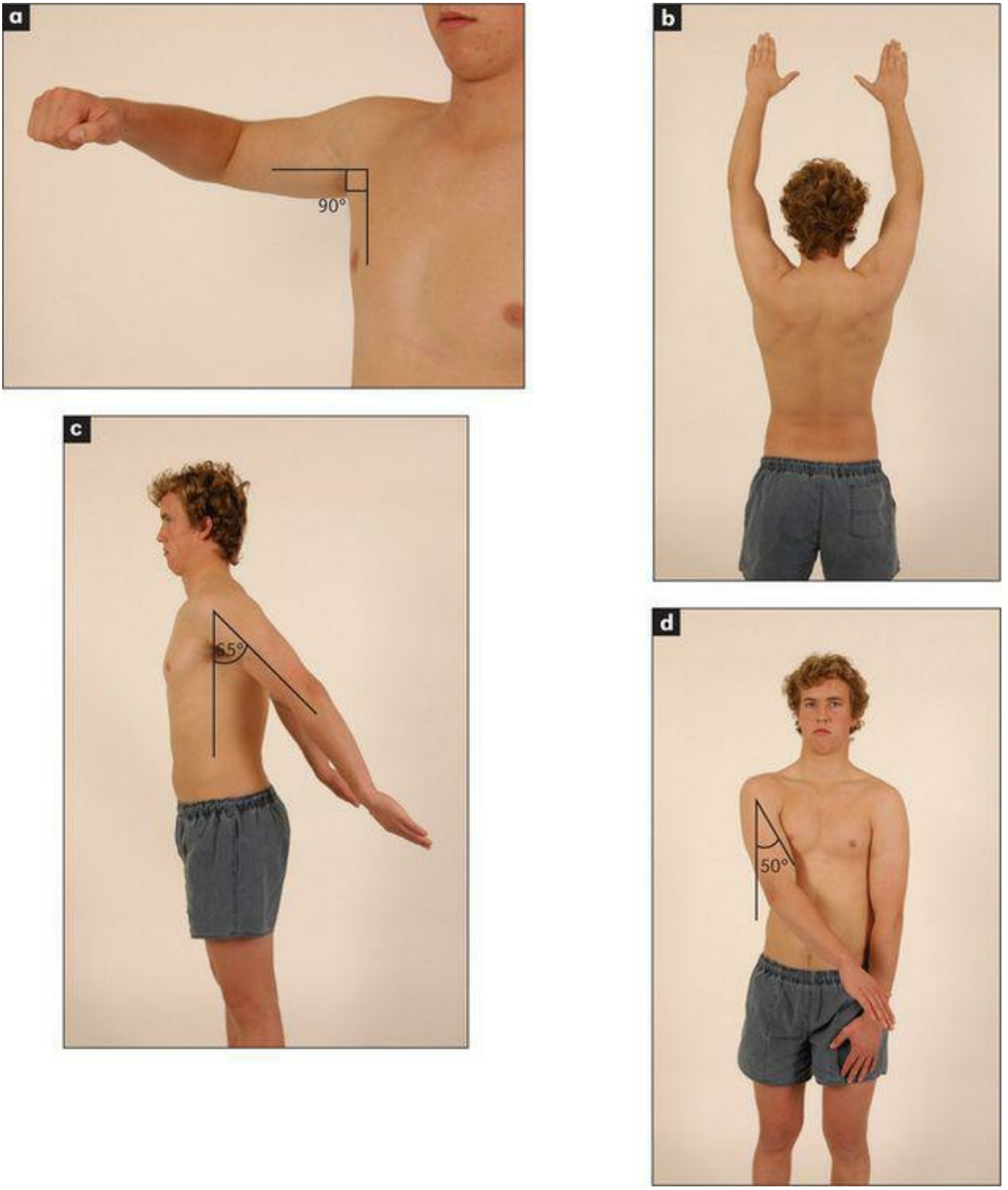


Figure 9.26 Movements of the shoulder joint
(a) Abduction using the glenohumeral joint. (b) Abduction using the glenohumeral joint and the scapula. (c) Extension. (d) Adduction.

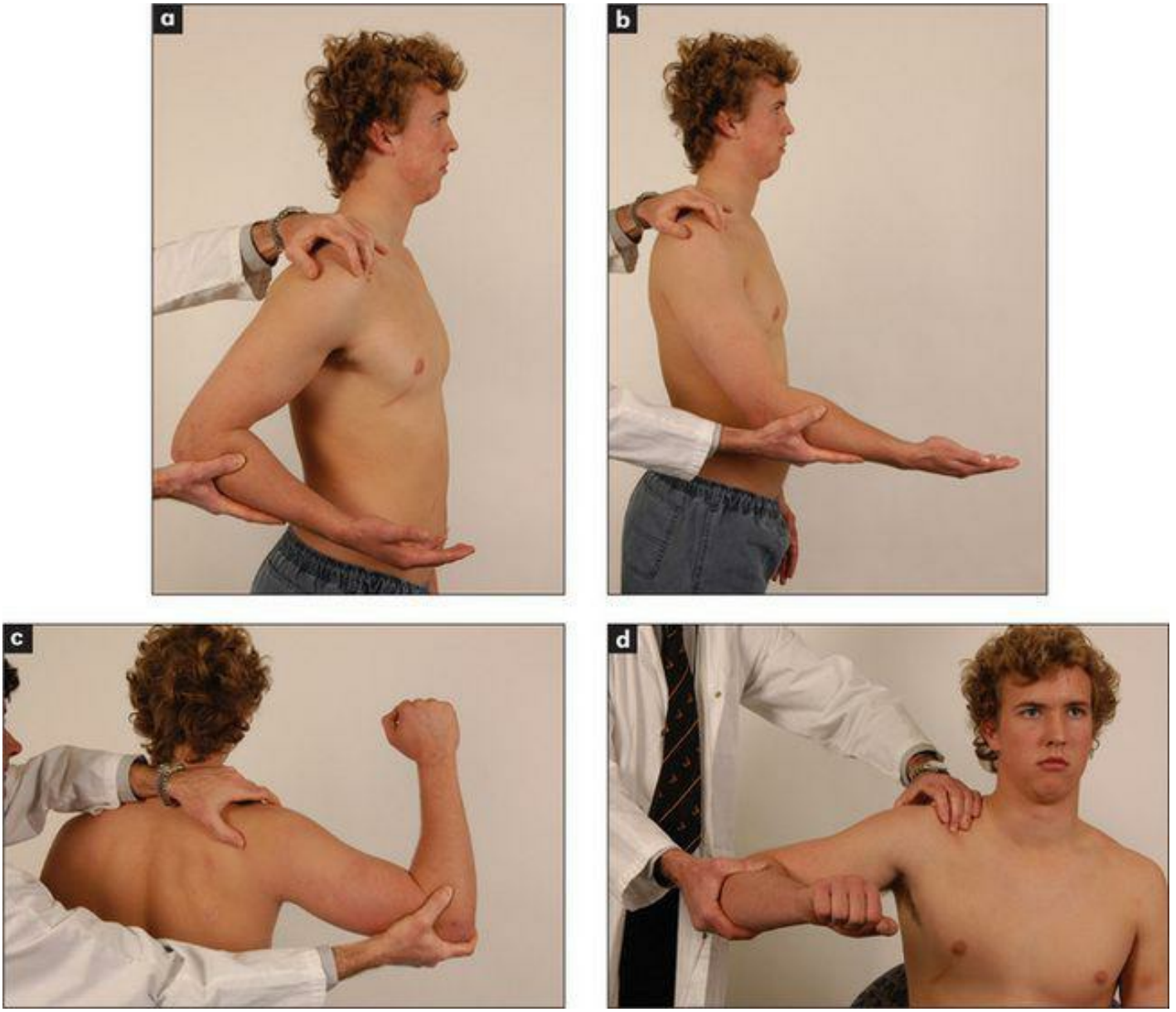


Figure 9.27 Examining the shoulder joint
(a) Extension. (b) Flexion. (c) Apprehension test. (d) Internal rotation and abduction.

Rapid assessment of shoulder movement is possible using the three-step 'Apley[i] scratch test' (Figure 9.28). Stand behind and ask the patient to scratch an imaginary itch over the opposite scapula, first by reaching over the opposite shoulder, next by reaching behind the neck and finally by reaching behind the back.

Figure 9.28 Apley scratch test to assess shoulder movements

The anterior stability of the shoulder joint is best assessed by the 'apprehension' test. Stand behind the patient, abduct, extend and externally rotate the shoulder (Figure 9.27c) while pushing the head of the humerus forwards with the thumb. The patient will strongly resist this manoeuvre if there is impending dislocation. There will be a similar response if the arm is adducted and internally rotated and posterior dislocation is about to occur.

This is also the time to test biceps function. The patient flexes the elbow against resistance. A ruptured biceps tendon causes the biceps muscle to roll up into a ball.

As a general rule, intra-articular disease produces *painful* limitation of movement in *all* directions, while tendinitis produces painful limitation of movement in *one* plane only, and tendon rupture or neurological lesions produce *painless* weakness. For example, if the abnormal sign is limited shoulder abduction in the middle range (45–135 degrees), this suggests 'rotator cuff' problems (i.e. the supraspinatus, infraspinatus, subscapularis and teres minor muscles) rather than arthritis.

In bicipital tendinitis there is localised tenderness on palpating over the groove. The supraspinatus tendon is a little higher, just under the anterior surface of the acromion. Supraspinatus tendinitis is common. Testing for it involves placing a finger over the head of the tendon while the shoulder is in extension. As this pushes the tendon forwards against the examiner's finger, the movement is painful. When the shoulder is then flexed the tendon moves away and the pain disappears.

Don't forget that arthritis affecting the acromioclavicular joint can be confused with glenohumeral disorders. Also remember to examine the neck and axillae in patients with shoulder pain.

The temporomandibular joints

History

The usual symptoms of temporomandibular joint dysfunction include clicking and pain on opening the mouth. The jaw may sometimes lock in the open position.

Examination

Look in front of the ear for swelling. **Feel** by placing a finger just in front of the ear while the patient opens and shuts the mouth (Figure 9.29). The head of the mandible is palpable as it slides forwards when the jaw is opened. Clicking and grating may be felt. This is sometimes associated with tenderness if the joint is involved in an inflammatory arthritis. Rheumatoid arthritis may affect the temporomandibular joint.

Figure 9.29 Examining the temporomandibular joints

The neck

Examination anatomy—the spine

The spinal column (Figure 9.30) is like a tower of bones that protects the spinal cord and houses its blood supply and efferent and afferent nerves. It provides mechanical support for the body and is flexible enough to allow bending and twisting movements. There are diarthrodial joints between the articular processes of the vertebral bodies, and the vertebral bodies are separated by the vertebral discs. These pads of cartilage are flexible enough to allow movement between the vertebrae. In the cervical spine from C3 to C7, the uncovertebral joints of Luschka[k] are present. These are formed between a lateral bony extension (uncinate process) from the margin of the more inferior vertebral body with the one above. Osteoarthritic hypertrophy of these joints may result in pain or nerve root irritation.

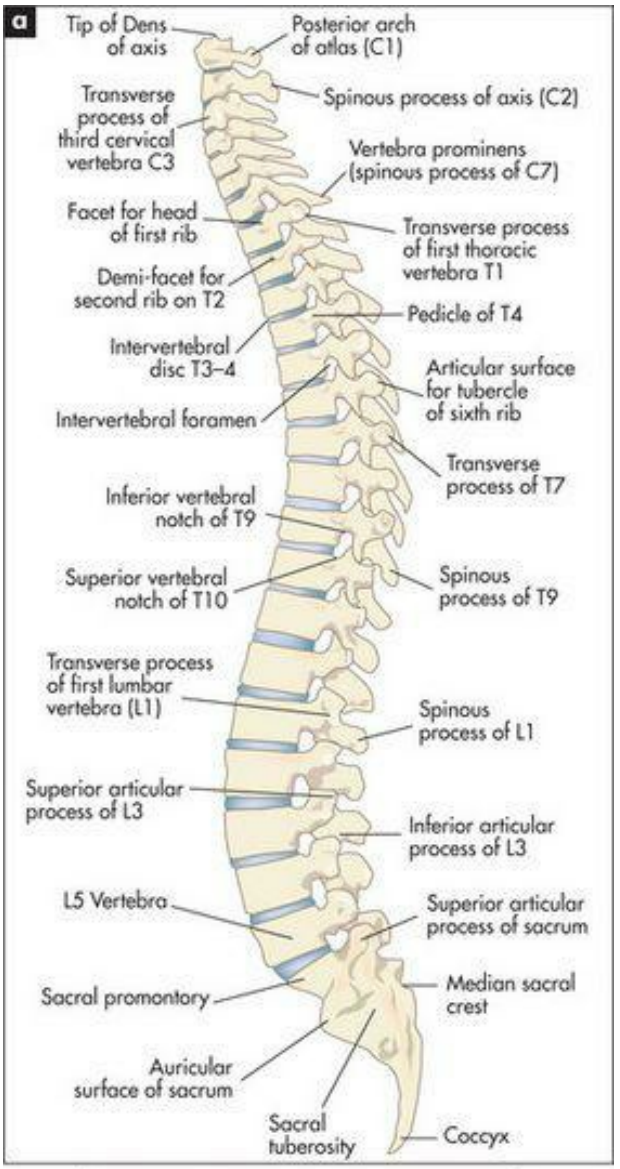


Figure 9.30 (a) Structure of the spine (b) MRI scan of the lumbar spine showing the anatomical features seen in (a)

MRI scan courtesy M Thomson, National Capital Diagnostic Imaging, Canberra.

History

Pain is the most common neck symptom. Musculoskeletal neck pain usually arises in the structures at the back of the neck: the cervical spine, the splenius, semispinalis and trapezius muscles, or in the cervical nerves or nerve roots. Pain in the front of the neck may come from the oesophagus, trachea, thyroid gland or anterior neck muscles e.g. the sternocleidomastoid and platysma. Pain may be referred to the front of the neck from the heart.

There may be a history of trauma from direct injury or a sudden deceleration causing hyperextension of the neck; 'whiplash' injury. Injury can also be caused by attempted therapeutic neck manipulations by physiotherapists or chiropractors. The possibility of spinal cord injury must be considered in these patients. Ask about weakness or altered sensation in the arms and legs and any problem with bowel or bladder function.

The pain may have begun suddenly, suggesting a disc prolapse, or more gradually due to disc degeneration.

Postural tendon and muscle strains are common causes of temporary neck pain. These are often related to overuse. Ask for the patient's occupation and whether work or recreational activities involve repeated and prolonged extension of the neck, e.g. painters and bicyclists. These patients often describe neck stiffness, and pain and muscle spasm are often present. The repeated holding of a telephone between the shoulder and the ear can cause nerve root problems. Neck movement may cause *radicular symptoms* such as paraesthesiae in the distribution of a cervical nerve after a hyperextension injury or cervical spine arthritis. Ask about paraesthesiae and weakness in the arms and hands.

Deformity may occur as a result of muscle spasm or sometimes following disc prolapse. *Torticollis* is a chronic and uncontrollable twisting of the neck to one side as a result of a muscle dystonia or cervical nerve root problem.

problem.

Examination

The patient should be undressed so as to expose the neck, shoulders and arms.

Look at the cervical spine while the patient is sitting up, and note particularly his or her posture (Figure 9.31). **Movement** should be tested actively. Flexion is tested by asking the patient to try to touch his or her chest with the chin (normal flexion is possible to 45 degrees). Extension (Figure 9.32a) is tested by asking the patient to look up and back (normally possible to 45 degrees). Lateral bending (Figure 9.32b) is tested by getting the patient to touch his or her shoulder with the ear; lateral bending is normally possible to 45 degrees. Rotation is tested by getting the patient to look over the shoulder to the right and then to the left. This is normally possible to 70 degrees.

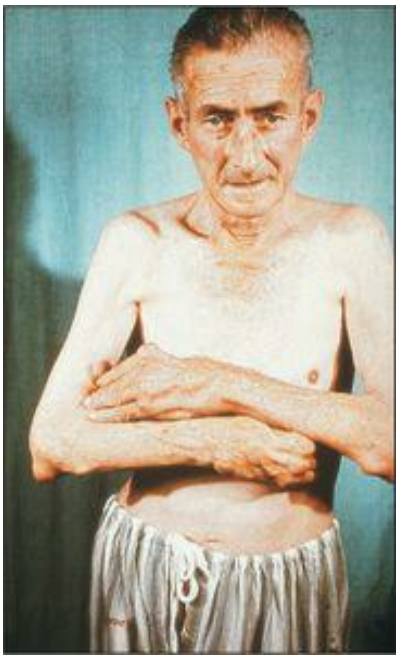


Figure 9.31 Rheumatoid arthritis
Note the head tilt due to right atlanto-axial subluxation, the rheumatoid hands and the subcutaneous rheumatoid nodules.

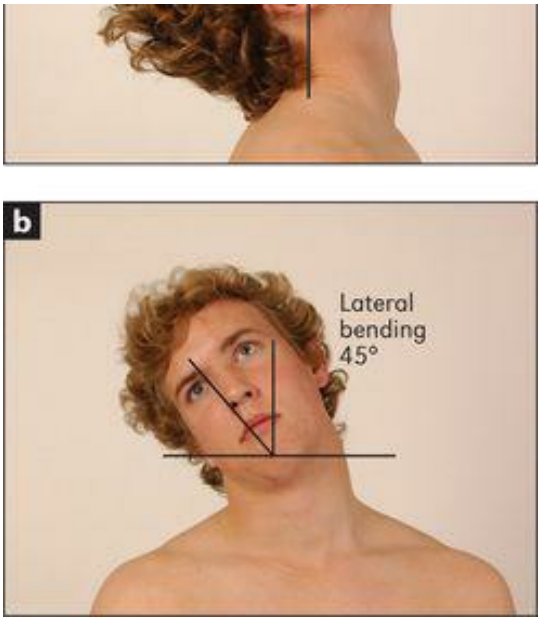


Figure 9.32 Movements of the neck
(a) Extension—'Look up and back'. (b) Lateral bending—'Now touch your right ear onto your shoulder' (45 degrees); rotation—'Now look over your shoulder to the right and then to the left' (70 degrees).

Feel the posterior spinous processes. This is often easiest to do when the patient lies prone with the chest supported by a pillow and the neck slightly flexed. The examiner should feel for tenderness and uneven spacing of the spinous processes. Tenderness of the facet joints will be elicited by feeling a finger's breadth lateral to the middle line on each side (Figure 9.33).

Figure 9.33 Examining the spinous processes

Neurological examination of the upper limbs, including testing of shoulder abduction (C5, C6) and the serratus anterior muscle (C5, C6, C7), is part of the assessment of the neck.

The thoracolumbar spine and sacroiliac joints

History

Lower back pain is a very common symptom (Table 9.12). The discomfort is usually worst in the lumbosacral area. Ask whether the onset was sudden and associated with lifting or straining or whether it was gradual.[1,2] Stiffness and pain in the lower back that is worse in the morning is characteristic of an inflammatory spondyloarthropathy. Pain that shoots from the back into the buttock and thigh along the sciatic nerve distribution is called '*sciatica*'. In sciatic nerve compression at a lumbosacral nerve root, the pain is often aggravated by coughing or straining. 'Lumbago' however is often due to referred pain (e.g. from the vertebral joints). There may be other *neurological symptoms* in the legs due to nerve compression or irritation. The distribution of the paraesthesiae or weakness may indicate the level of spinal cord or nerve root abnormality. One should also ask about urinary incontinence and retention as well as numbness in the 'saddle region', erectile dysfunction and bowel incontinence, which can be a result of cauda equina involvement.

TABLE 9.12 Differential diagnoses for back pain

Remember that serious causes of back pain are rare in otherwise well patients (<1%).

denotes symptoms for the possible diagnosis of an urgent or dangerous problem. !

Suggests non-specific or musculoskeletal cause (although often said to be due to disc herniation, there is little correlation between MRI-scan-detected disc herniation and pain—it is found in 30% of asymptomatic people)

Gradual onset

No neurological symptoms or signs

Recent minor injury

Suggests ankylosing spondylitis

Systemic symptoms

Pain at rest

Suggests malignant pain !

Worse at rest, keeps patient awake

Present for more than 4 weeks

Weight loss

Known malignancy

Suggests abscess !

Worse at rest

Fever

Immunosuppression

Suggests cauda equina syndrome (compression of sacral nerve roots usually due to large midline herniation of a disc, but can be caused by infection or malignancy that causes narrowing of the spinal canal)

Severe pain

Urinary retention or incontinence

Faecal incontinence

Saddle anaesthesia

Leg weakness !

Suggests fracture of vertebral body

Sudden onset of severe pain

Known osteoporosis

Steroid use

Trauma

Tenderness over vertebral body

Suggests sciatica (irritation or compression of L4–S1 nerve roots)

Pain radiates down the leg beyond the knee

Suggests spinal canal stenosis

Pain worse with walking

Improved by sitting forward

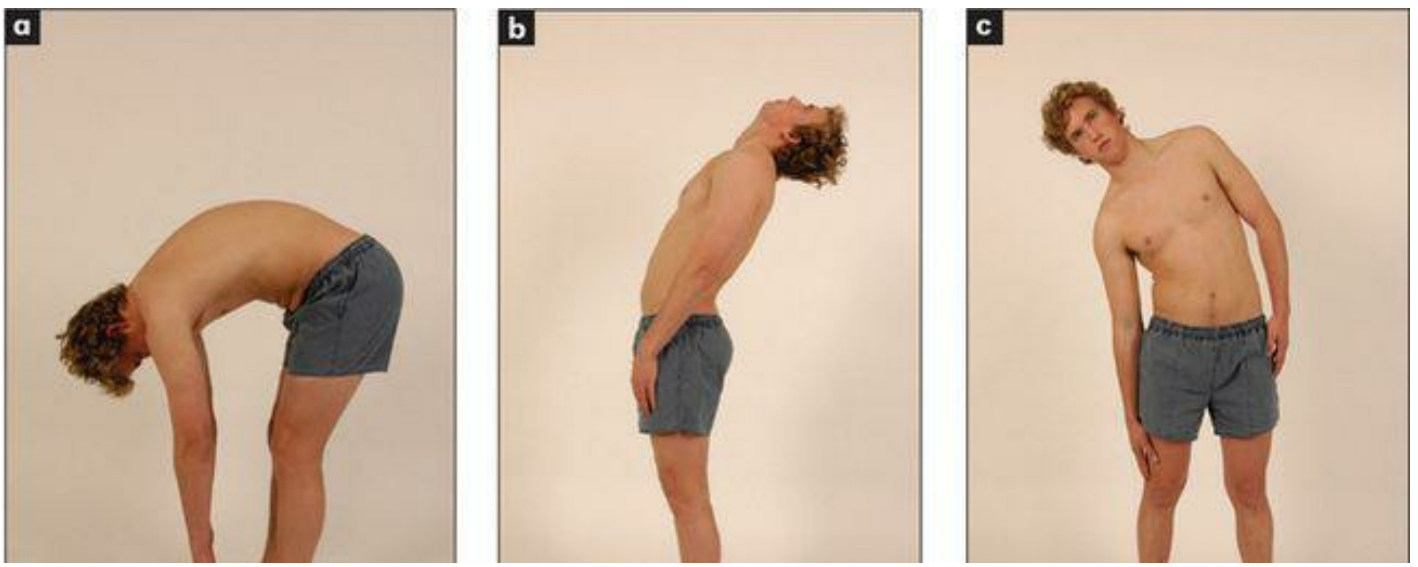
improved by sitting forward
Suggests referred pain Abdominal pain (diverticular abscess, pyelonephritis) Nausea and vomiting, dysuria (pyelonephritis) Sudden-onset tearing pain, hypotension, shock (ruptured abdominal aortic aneurysm)

Examination

To start the examination, have the patient standing and clothed only in underpants. **Look** for deformity, inspecting from both the back and side. Note especially loss of the normal thoracic kyphosis and lumbar lordosis, which is typical of ankylosing spondylitis. Also note any evidence of scoliosis, a lateral curvature of the spine which may be simple ('C' shaped) or compound ('S' shaped) and which can result from trauma, developmental abnormalities, vertebral body disease (e.g. rickets, tuberculosis) or muscle abnormality (e.g. polio).

Feel each vertebral body for tenderness and palpate for muscle spasm.1

Movement is assessed actively. Bending movements largely take place at the lumbar spine, while rotational movements occur at the thoracic spine. Range of movement is tested by observation (Figure 9.34) and the use of Schober's test (see below) (Figure 9.35).



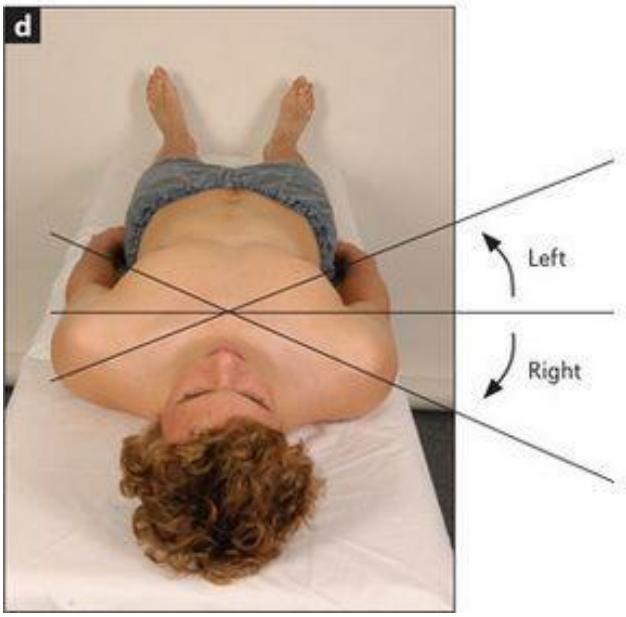


Figure 9.34 Movements of the thoracolumbar spine
(a) Flexion. (b) Extension. (c) Lateral bending. (d) Rotation.

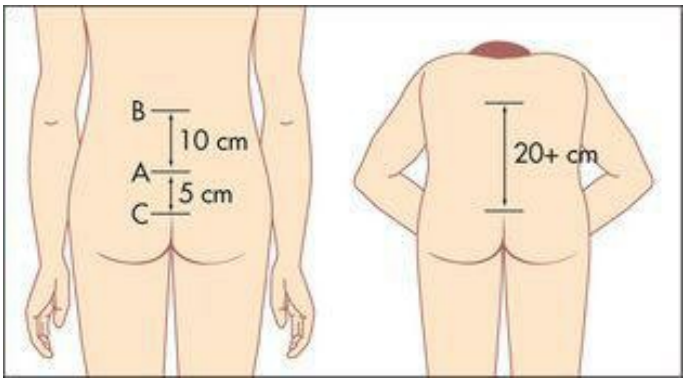


Figure 9.35 Schober's test

From Douglas G, Nicol F and Robertson C, ***Macleod's Clinical Examination****, 12th edn. Edinburgh: Churchill Livingstone, 2009, with permission.*

Flexion is tested by asking the patient to touch the toes with the knees straight. The normal range of flexion is very wide. Many people can reach only halfway down the shins when the knees are kept straight. As the patient bends, look at the spine: there is normally a gentle curve along the back from the shoulders to the pelvis. Patients with advanced ankylosing spondylitis

have a flat ankylosed spine and all the bending occurs at the hips. Test *extension* by asking the patient to lean backwards. Patients with back pain usually find this less uncomfortable than bending forwards. *Lateral bending* is assessed by getting the patient to slide the right hand down the right leg as far as possible without bending forwards, and then the same for the left side. This movement tends to be restricted early in ankylosing spondylitis. *Rotation* is tested with the patient sitting on a stool (to fix the pelvis) and asking him or her to rotate the head and shoulders as far as possible to each side. This is best viewed from above.

Measure the lumbar flexion with *Schober's test* (Figure 9.35). A mark is made at the level of the posterior iliac spine on the vertebral column (approximately at L5). One finger is placed 5 cm below and another 10 cm above this mark. The patient is then asked to touch the toes. An increase of less than 5 cm in the distance between the two fingers indicates limitation of lumbar flexion. The finger-to-floor distance at full flexion can be measured serially to give an objective indication of disease progression.

Assess *straight leg raising* (Lasègue's[l] test includes passive ankle dorsiflexion). With the patient lying down, lift the straightened leg if sciatica is suspected (normally to 80–90 degrees). This will be limited by pain in lumbar disc prolapse (less than 60 degrees).

Press directly on the anterior superior iliac spines and apply lateral pressure so as to attempt to separate them. This will cause pain in the sacroiliac joints when patients have sacroiliitis.

Now get the patient to lie in bed on the stomach. Look for gluteal wasting. The sacroiliac joints lie deep to the dimples of Venus.[m] By tradition, firm palpation with both palms overlying each other is used to elicit tenderness in patients with sacroiliitis. Test each side separately.

Now ask the patient to lie on one side. Apply firm pressure to the upper pelvic rim. This will also elicit pain in the sacroiliac joints.

The complete examination of the back also requires neurological assessment of the lower limbs.[6]

The hips

Examination anatomy (Figure 9.36)

The hip is a ball-and-socket synovial joint. The socket is formed by three bones: the ilium, ischium and pubis. The ball is the head of the femur. Surrounding tendons and nerves may cause symptoms that need to be distinguished from hip abnormalities.

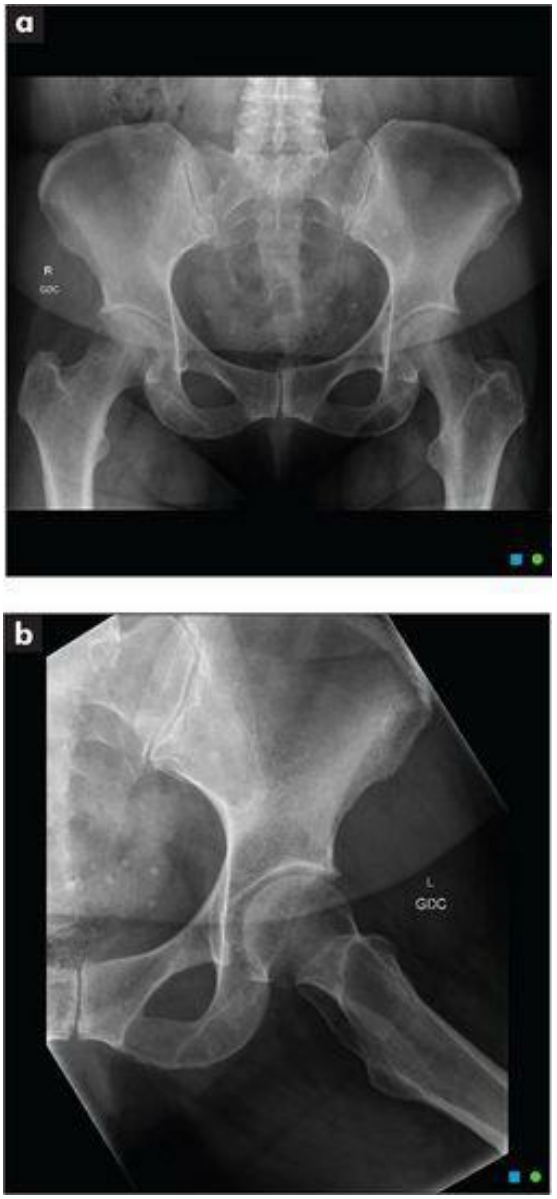


Figure 9.36 X-rays of (a) pelvis and hip joints; (b) hip in abduction

Courtesy M Thomson, National Capital Diagnostic Imaging, Canberra.

History (Table 9.13)

The word 'hip' is used variably by patients to indicate a number of sites including the buttocks, low back, or trochanteric region. Ask the patient to point to the site of pain. The patient with true hip joint problems will often have *pain* that is felt anteriorly in the groin or may radiate to the knee. Athletes with 'groin strain' often have adductor tendinitis or osteitis pubis caused by trauma or overuse. Find out what sport the patient plays. The condition is common in sports involving running. Typically the pain is present

condition is common in sports involving running. Typically the pain is present at the start of exercise and improves as the athlete 'warms up', only to recur later at rest. Take a detailed work history. Overuse syndromes related to work may be worst on Fridays and improve over the weekend. Jumping down off trucks or platforms may cause repeated trauma to the joint.

TABLE 9.13 Differential diagnosis of hip and thigh pain

Favours fractured neck of femur Known osteoporosis History of a fall Severe sudden pain Inability to bear weight
Favours osteoarthritis Advanced age Obesity Gradual onset Pain when walking Work involves jumping off trucks or platforms
Favours rheumatoid arthritis

Pain at rest

Pain worst in the morning

Other typical joint involvement

Walking may be severely limited

Favours septic arthritis

Fever

Malaise

Favours aseptic necrosis of the femoral head

Sudden onset of pain

Inability to bear weight on leg

Steroid use

Known fracture

Diabetes mellitus

Sickle cell anaemia

Favours meralgia paraesthetica (lateral cutaneous nerve of the thigh entrapment)

Anterior thigh pain with paraesthesiae

Occupation involves long periods of sitting

Use of a constricting lumbar support belt

Favours trochanteric bursitis

Pain involves lateral thigh

Worse when climbing stairs

A *limp* may be noticed by the patient. When associated with pain it is a compensating mechanism but, when painless, may be due to differing limb length or instability of the joint. Patients are sometimes aware of *clicking* or *snapping* coming from the region of the hip. This may be due to a psoas bursitis or to slipping of the tendon of the gluteus maximus over the edge of the greater trochanter. *Functional impairment* usually results in difficulty walking and climbing stairs. Sitting down and standing up can become progressively more uncomfortable because of stiffness and pain.

A history of a fall and inability to walk or bear weight on the leg suggests a fracture of the neck of the femur. A history of rheumatoid arthritis and pain which is present at rest suggests rheumatoid arthritis of the hip. Osteoarthritis is more likely to evolve gradually in older people and is associated with obesity and with recurrent trauma.

Ask about systemic symptoms such as fever and weight loss which might be a sign of septic arthritis.

Pain which is associated with paraesthesiae and radiates in the distribution of the lateral cutaneous nerve of the thigh suggests an entrapment syndrome (meralgia paraesthetica).

Examination

Watch the patient walking into the room and note the use of a walking stick, a slow and obviously uncomfortable gait, or a limp.

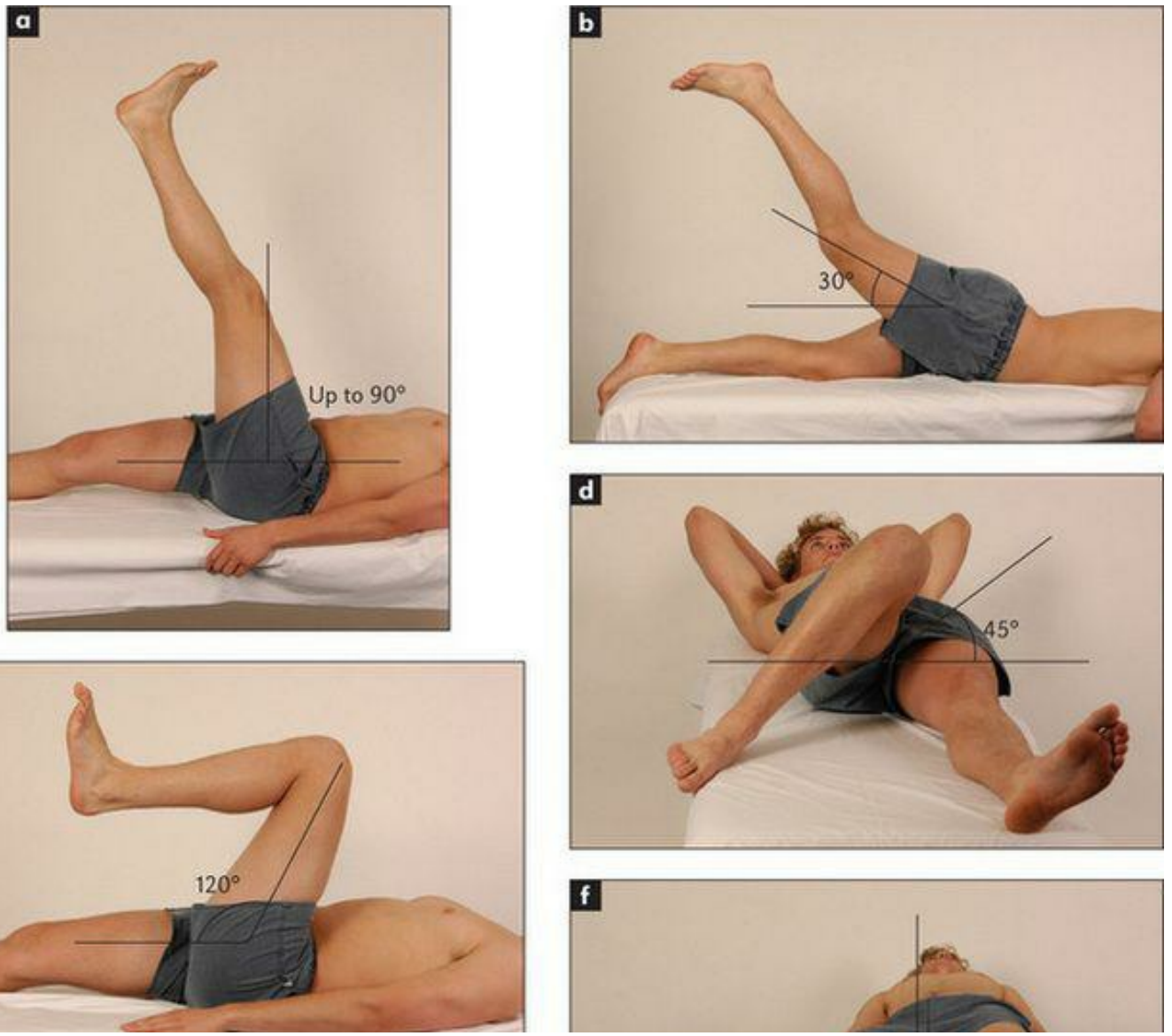
Get the patient to lie down, first on the back.

Looking at the hip joint itself is not possible because so much muscle overlies it. However, the examiner must inspect for scars and deformity. The patient may adopt a position with one leg rotated because of pain.

Feel just distal to the midpoint of the inguinal ligament for joint tenderness. This point lies over the only part of the femoral head that is not intra-acetabular. Now feel for the positions of the greater trochanters. The examiner's thumbs are placed on the anterior superior iliac spines on each side while the fore and middle fingers move posteriorly to find the tips of the greater trochanters. These should be at the same level. If one side is higher than the other, the higher side is likely to be the abnormal one.

Move the hip joint passively (Figure 9.37). *Flexion* is tested by flexing the patient's knee and moving the thigh towards the chest. The examiner

keeps the pelvis on the bed by holding the other leg down. A fixed flexion deformity (inability to extend a joint normally) may be masked by the patient's arching the back and tilting the pelvis forward and increasing lumbar lordosis unless *Thomas's test*[n] is applied. The legs are fully flexed to straighten the pelvis. One leg is then extended. A fixed flexion deformity (e.g. as result of osteoarthritis) will prevent straightening. *Rotation* is tested with the knee and hip flexed. One hand holds the knee, the other the foot. The foot is then moved medially (*external rotation of the hip*, normally possible to 45 degrees), then laterally (*internal rotation of the hip*, normal to 45 degrees). *Abduction* is tested by standing on the same side of the bed as the leg to be tested. The right hand grasps the heel of the right leg while the left hand is placed over the anterior superior iliac spine to steady the pelvis. The leg is then moved outwards as far as possible. This is normally possible to 50 degrees. *Adduction* is the opposite. The leg is carried immediately in front of the other limb and this is normally possible to 45 degrees.



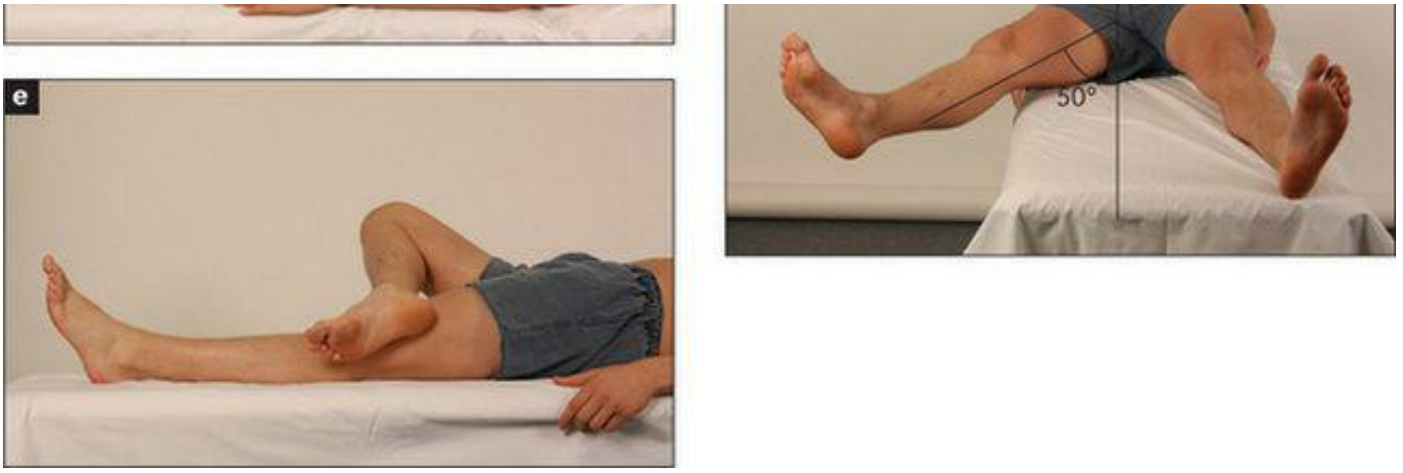


Figure 9.37 Movements of the hip
(a) Flexion. (b) Extension. (c) Flexion, knee bent. (d) Internal rotation. (e) External rotation. (f) Abduction.

Ask the patient to roll over onto the stomach. *Extension* is then tested by placing one hand over the sacroiliac joint while the other elevates each leg. This is normally possible to about 30 degrees. Ask the patient to stand now and perform the Trendelenburg[o] test. The patient stands first on one leg and then on the other. Normally the non-weightbearing hip rises, but with proximal myopathy or hip joint disease the non-weightbearing side sags.

Finally, the true *leg length* (from the anterior superior iliac spine to the medial malleolus) and apparent leg length (from the umbilicus to the same lower point) for each leg should be measured. A difference in true leg length indicates hip disease on the shorter side, while apparent leg length differences are due to tilting of the pelvis.

In patients with osteoarthritis of the joint, internal rotation, abduction and extension are usually restricted.[7] Osteoarthritic joints (Figure 9.38) show loss of joint space, sclerosis (thickening and increased radiodensity) at the joint margins and osteophyte (bony outgrowth) formation on plain X-ray films.

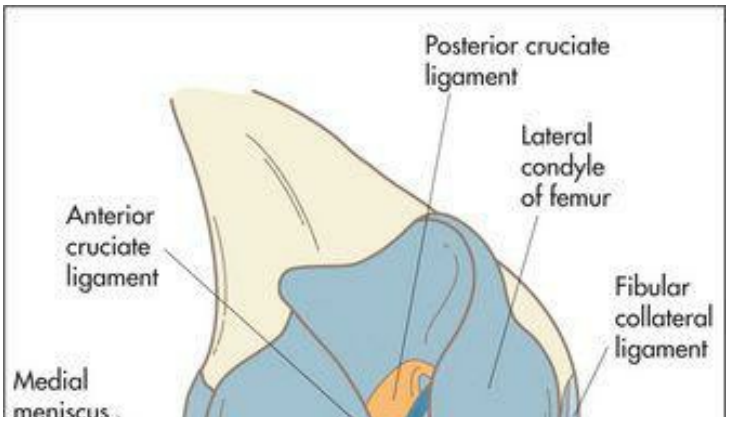
Figure 9.38 Osteoarthritis arthritis
Anteroposterior X-ray of the hip showing the features of osteoarthritis. The left side is more severely affected than the right; note sclerosis, osteophyte formation and asymmetrical joint space narrowing.

Courtesy Canberra Hospital X-ray library.

The knees

Examination anatomy (Figure 9.39)

The knee is a complex hinge joint formed by the distal femur, the patella and the proximal end of the tibia. The bones are enclosed in a joint capsule with an extensive synovial membrane. Lateral stability is provided by the lateral collateral ligaments and antero-posterior movement is restricted by the cruciate ligaments. There is extensive articular cartilage which acts as a shock absorber and allows smooth gliding movements between the ends of the bones.



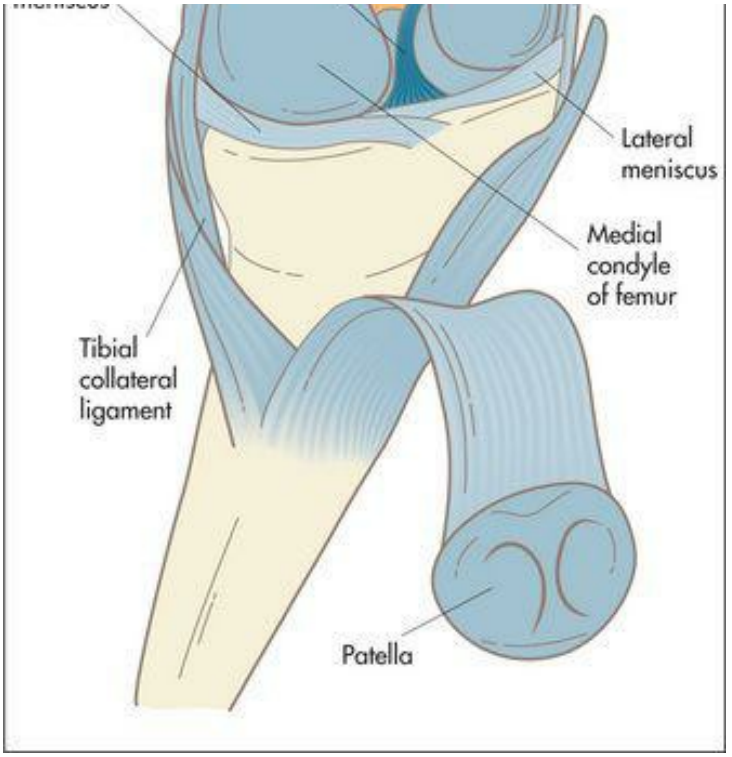


Figure 9.39 Knee anatomy

History (Table 9.14)

Pain is a common knee problem. If there has been an injury or it is due to a mechanical abnormality, it is often localised. Inflammatory diseases more often cause diffuse pain. Ask the patient to point to the place where the pain is most severe. *Stiffness* is usually of gradual onset and is typical of osteoarthritis. It tends to be worse after inactivity. *Locking* of the knee usually means there is a sudden inability to reach full extension. The knee is often stuck at about 45 degrees of flexion. Unlocking may occur just as suddenly, sometimes following some form of manipulation by the patient. The cause is mechanical: a loose body or torn meniscus has become wedged between the articular surfaces of the joint. *Swelling* may occur suddenly after an injury, suggesting it is due to haemarthrosis from a fracture or ligamentous tear; if swelling occurs after a few hours a torn meniscus is more likely to be the cause. Arthritis and synovitis cause a chronic swelling. Patients sometimes notice *deformity*, which in later life is usually due to arthritis. Sometimes the patient may complain that the knee is *unstable* or *gives way*. Patellar instability and ruptured ligaments may present this way. One should always ask about *loss of function.* There is often a reduced ability to walk distances, climb stairs and get into and out of chairs.

TABLE 9.14 Differential diagnosis of knee pain

Area of pain	Associated features
Lateral aspect of knee	
Tear of lateral meniscus	History of trauma
	Locking or clicking
	Swelling delayed after injury
Tear of lateral collateral ligament	Knee gives way
Biceps femoris strain	Overuse or injury
Medial aspect of knee	
Tear of medial meniscus	History of trauma
	Locking or clicking
	Swelling delayed after injury
Tear or strain of medial collateral ligament	Knee gives way
Hamstring strain	Overuse or injury
Patellofemoral syndrome	Overuse
	Chronic symptoms
Back of the knee	
Baker's cyst	Sudden pain
	Localised swelling and tenderness
Bursitis, e.g. popliteal, semimembranosus	Overuse pattern
	Chronic pain
Hamstring strain	Injury or overuse
Deep venous thrombosis	
Front of the knee	
	Injury

Patellar fracture	Sudden pain and tenderness
	Swelling
	Separation of fractured segments, visible or palpable
Patellar tendinitis	Overuse
Osteoarthritis	Chronic pain
	Worse with walking
	History of old injuries
Prepatellar bursitis (housemaid's knee*)	Occupation
Infrapatellar bursitis (clergyman's knee)	Occupation

* Described by Henry Hamilton Bailey (1894–1961) as 'the most elementary diagnosis in surgery'.

Osteoarthritis of the knee is very common. Older age, previous injury and stiffness lasting less than half an hour are in favour of this diagnosis as the cause of knee pain. *Good signs guide 9.1* outlines the symptoms and signs of this condition. Physically active adolescents may present with pain and swelling below the knee at the point of attachment of the patellar tendon to the tibial tuberosity—tibial apophysitis or Osgood Schlatter's disease.[p] This is the most common *traction apophysitis*.

GOOD SIGNS GUIDE 9.1 Osteoarthritis as the cause of chronic knee pain

Symptom or sign	LR positive	LR negative
Stiffness < 30 mins	3.0	0.2
Crepitus on passive movement	2.1	0.2
Bony enlargement	11.8	0.5
Palpable increase in temperature	0.3	1.6
Valgus deformity	1.4	0.9
Varus deformity	3.4	0.8
At least 3 of the above	3.1	0.1

From McGee S, Evidence-based physical diagnosis, 2nd edn. St Louis: Saunders, 2007.

Ask if there has been previous knee surgery or arthroscopy.

Take an occupational and sporting history. Injury and overuse syndromes are often related to exercise (particularly competitive sport) and occupations associated with repetitive minor injuries to the knees.

Examination

This is performed with the patient in a number of positions and, of course, walking.[8,9] Even more than with the other joints, it is important to examine the more normal or uninjured knee first. This will help with the interpretation of changes in the other knee and give the patient more confidence that the examination will not be painful.

Look first with the patient lying down on the back with both knees and thighs fully exposed. The affected knee will often be flexed, the most comfortable position. Note any quadriceps wasting. This begins quite soon after knee abnormalities lead to disuse of the muscle. Examine the knees themselves for skin changes, scars (including those from previous surgery or

arthroscopy), swelling and deformity. Compare each side with the other. Localised swellings may move about as the knee flexes and extends. They are often cartilaginous loose bodies. Fixed lumps in the line of the joint may be meniscal cysts.

Swelling of the synovium or a knee effusion is usually seen medial to the patella and in the joint's suprapatellar extension. Loss of the peripatellar grooves may be an early sign of an effusion. Assess fixed flexion deformity by squatting down and looking at each knee from the side. A space under the knee will be visible if there is permanent flexion deformity arthritis.

Varus and valgus deformity may be obvious here but are more easily seen when the patient stands. Varus deformity is often related to osteoarthritis and valgus deformity to rheumatoid arthritis.

Now watch as the patient flexes and straightens each knee in turn. As the knee extends the patella glides upwards and remains centred over the femoral condyles. If there is patellar subluxation it will slip laterally during knee flexion and return to the midline during knee extension.

Feel the quadriceps for wasting. Palpate over the knees for warmth and synovial swelling.

Test carefully for a joint effusion. The *patellar tap* is used to confirm the presence of large effusions (Figure 9.40). One hand rests over the lower part of the quadriceps muscle and compresses the suprapatellar extension of the joint space. The other hand pushes the patella downwards. The sign is positive if the patella is felt to sink and then comes to rest with a tap as it touches the underlying femur. The *bulge sign* is used to detect small effusions. Here the left hand compresses the suprapatellar pouch while the fingers of the right hand are run along the groove beside the patella on one side and then the other. A bulging along the groove due to a fluid wave, on the side not being compressed, is a sign of a small effusion.

Figure 9.40 Testing for patellar effusion
(a) The patellar tap. (b) The bulge sign: compressing the suprapatellar pouch.

Examine for patellofemoral lesions by sliding the patella sideways across the underlying femoral condyles.

Move the joint passively. Test *flexion* (normally possible to 135 degrees) and *extension* (normal to 5 degrees) by resting one hand on the knee cap while the other moves the leg up and down (Figure 9.41a). The range of movements and the presence of crepitus are noted. While holding the knee flexed, feel for and attempt to localise tenderness. Feel gently for tenderness along the joint line at the patellar ligament and at the sites of attachment of the collateral ligaments.

Figure 9.41 Knee examination
(a) Testing knee flexion. (b) Testing the collateral ligaments. (c) Testing the cruciate ligaments.

Test the *ligaments* next. The lateral and medial *collateral ligaments* are assessed by having the knee slightly flexed while holding the leg, with the examiner's forearm resting along the length of the tibia; lateral and medial movements of the leg on the knee joint are tested (Figure 9.41b). Meanwhile the thigh is steadied with the other hand. Movements of more than 5–10 degrees are abnormal. The *cruciate ligaments* (Figure 9.41c) are tested next. The examiner steadies the patient's foot with an elbow or by sitting on it. The patient's knee is flexed to 90 degrees. The examiner's hands grasp the tibia and attempt anterior and posterior movements of the leg on the knee joint. Movement may be detected by the examiner's thumbs positioned at the joint margins. Again, movement of more than 5–10 degrees is abnormal. Increased anterior movement suggests anterior cruciate ligamentous laxity, and increased posterior movement suggests posterior cruciate ligamentous laxity. The Lachman test may be more accurate (positive LR 42.0, negative LR 0.1).[8] Here the knee is flexed 20–30 degrees while the patient is lying supine. Grasp the femur (place your hand above the knee) to steady it, then grab the lower leg below the knee and give it a quick forward tug. It is abnormal when there is exaggerated anterior tibial movement or the knee fails to stop with a thud.

When recurrent dislocation or subluxation of the patella is suspected, the *patellar apprehension test* should be performed. Push the patella firmly in a lateral direction while slowly flexing the knee. The patient's face should be studied for the anxious look that suggests impending dislocation (it is then time to suspend the test).

Ask the patient to roll into the prone position. Look and feel in the popliteal fossa for a Baker's cyst.[q] This is a pressure diverticulum of the synovial membrane that occurs through a hiatus in the knee capsule (Figure 9.42). It is best seen with the knee extended. Rupture of this into the calf muscle produces signs that may mimic a deep venous thrombosis. Rupture is often associated with the 'crescent sign'— ecchymoses below the malleoli of the ankle. A Baker's cyst must be distinguished from an aneurysm of the popliteal artery, which will be pulsatile, and a bony tumour (very hard).

Figure 9.42 Baker's cyst of the right knee, viewed from behind

This is also the position in which Apley's *grinding test* may be performed (Figure 9.43). This is a test of meniscal damage. The patient's leg is flexed to 90 degrees, the examiner stabilises the thigh by kneeling lightly on it and while pressing on the foot rotates the leg backwards and forwards. Pain or clicking make the test positive. The *distraction test* is the opposite. Here the patient's leg is pulled upwards so as to take the strain off the menisci and stretch the ligaments. If the patient finds the test painful, a ligamentous abnormality may be the cause.

Figure 9.43 Apley's grinding test (push hard)

McMurray's[r] test (Figure 9.44) is another way of detecting a meniscal tear. The patient lies on the back, the examiner stands on the side to be tested and holds the ankle. The examiner's other hand sits on the medial side of the knee and pushes to apply valgus force. The patient's leg is then extended from the flexed position while being internally and then externally rotated. The test is positive if there is a popping sensation, which may be followed by inability to extend the knee.

Figure 9.44 McMurray's test of the knee

Stand the patient up. Look particularly for varus (bow-leg) and valgus (knock-knee) deformity.

Finish with a test of function. Get the patient to walk to and fro. Study the gait and the movement of the knees, particularly for a sideways wobble.

The ankles and feet

Examination anatomy (Figure 9.45)

The ankle is a synovial hinge joint formed between the distal ends of the tibia

and the fibula, and the talus bone. Protrusions from the ends of the tibia and fibula, which are called malleoli, form a socket that in combination with lateral ligaments stabilises the joint. The proximal part of the foot is called the *tarsus* and contains the seven tarsal bones (talus, calcaneus [heel] navicular, cuboid and the three cuneiform bones) with their supporting ligaments and joint capsules. The joints and ligaments around these bones allow the movements of the foot: inversion and eversion, dorsi- (upward) and plantar (downward) flexion.

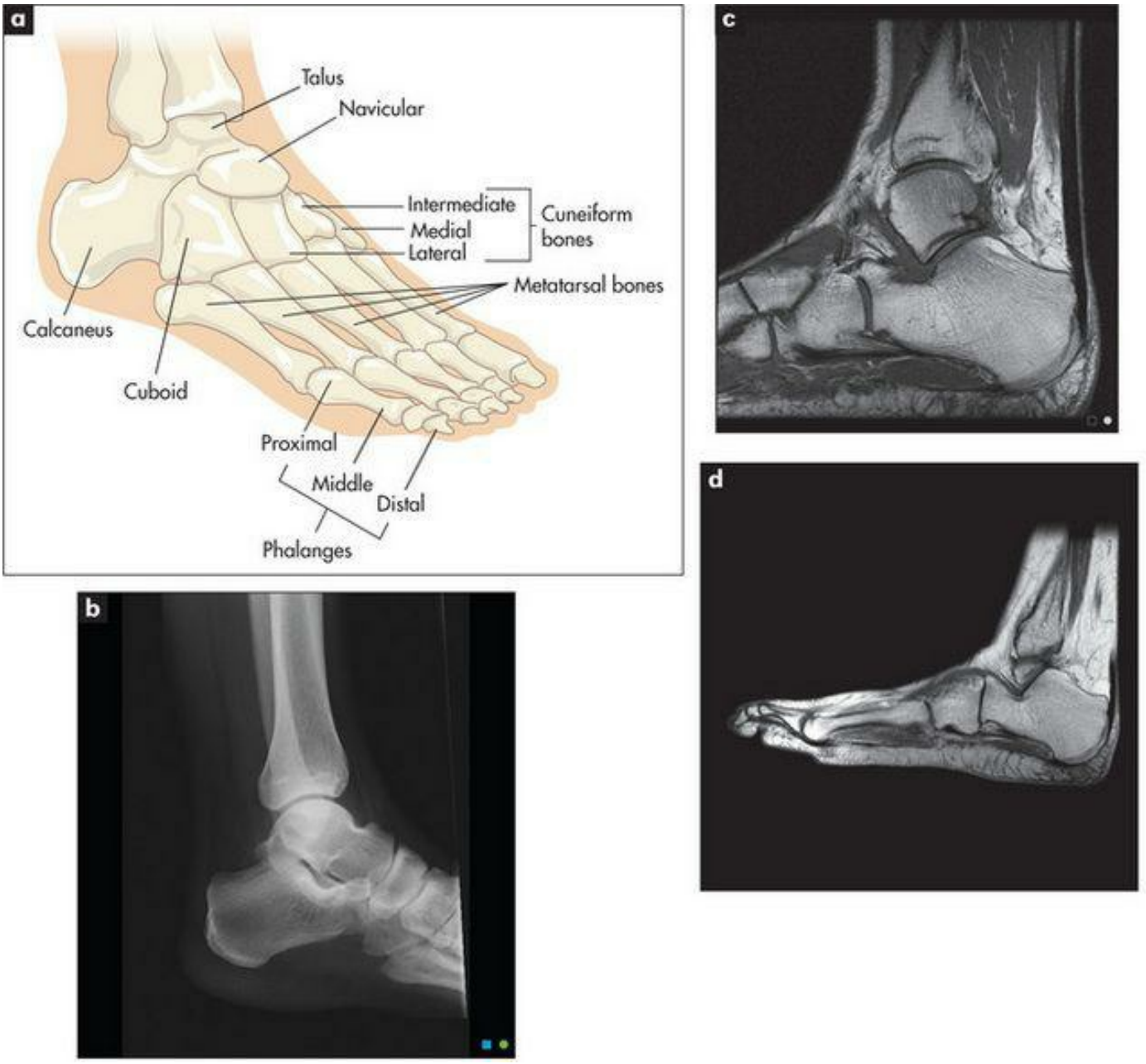


Figure 9.45 The ankles and feet
(a) Anatomy of the ankle and foot. (b) X-ray of the ankle. (c) MRI scan of the ankle. (d) MRI scan of the left foot.

X-ray and MRI scans courtesy M Thomson, National Capital Diagnostic Imaging, Canberra.

History

The usual symptom is pain. If this is present only when the patient wears shoes, the shoes rather than the feet may be the problem. There may be a specific area that is painful and the patient should be asked to point to this. There may be a history of injury or of intensive or unusual exercise. Ankle injuries are common in certain sports that involve twisting of the foot on the leg (e.g. netball, football) (Table 9.15). Rupture of the Achilles tendon occurs in squash and tennis players in patients over 50 and following forced dorsiflexion of the foot.

TABLE 9.15 Differential diagnoses of ankle pain

Chronic or persistent pain suggests Osteoarthritis (worse with walking) Inflammatory arthritis (often painful at rest)
Pain behind the ankle suggests Achilles tendinitis (tender lump behind foot, associated with rheumatoid arthritis) Achilles tendon rupture (pain sudden and severe)
Pain over lateral aspect of ankle suggests Lateral ligament injury—sprain (history of forced inversion of the ankle) Lateral malleolus fracture (severe pain, history of trauma)

Lateral malleolus fracture (severe pain, history of trauma)
Pain over medial aspect of ankle suggests Deltoid ligament injury—sprain (history of forced eversion of the ankle) Posterior tibial tendinitis Tarsal tunnel syndrome (posterior tibial nerve entrapment) Fracture of medial malleolus (severe pain, history of trauma)

Patients with foot (Table 9.16) or ankle pain may have a history of rheumatoid arthritis. This can cause pain and deformity and affect the ankle subtalar, midtarsal and metatarsophalangeal joints.

TABLE 9.16 Differential diagnoses of foot pain

Hind foot or midfoot pain suggests Osteoarthritis Rheumatoid arthritis Plantar fibromas Plantar fasciitis (heel pain)
Forefoot pain suggests Metatarsalgia Metatarsal fracture Interdigital neuroma (interdigital nerve entrapment neuropathy)

Gout (severe pain and swelling, usually of first metatarsophalangeal joint)

Toe problems (bunions, ingrown toenail, claw toes, hammer toes)

Very severe pain involving the first metatarsophalangeal joint is usually due to gout. Pain right over one of the metatarsals that comes on after unusually vigorous exercise may be due to a stress fracture.

GOOD SIGNS GUIDE 9.2 Ligament and meniscal injuries

Finding*	Sensitivity (%)	Specificity (%)	Positive LR	Negative LR
Detecting anterior cruciate ligament tear*				
Anterior drawer sign	27–88	91–99	11.5	0.5
Lachman's sign	48–96	90–99	17.0	0.2
Pivot shift sign	6–32	96–99	8.0	NS
Detecting meniscal injury*				
McMurray sign	17–29	96–98	8.2	0.8
Joint line tenderness	58–85	30–53	NS	NS
Block to full extension	44	86	3.2	0.7

NS = not significant.
* Diagnostic standard: for anterior cruciate tear, tear demonstrated by MRI imaging, arthroscopy, or surgery; for meniscal tear, arthroscopy.
* Definition of findings: see text.
From McGee S, *Evidence-based physical diagnosis*, 2nd edn. St Louis: Saunders, 2007.

There may be deformity involving the ankle or toes. Patients find this especially troublesome if it makes it difficult to put on shoes. The patient may have noticed swelling; ask if this is painful or not and whether it involves one or both feet. Bilateral swelling is more likely due to inflammation. Swelling over the medial aspect of the first metatarsal head (a bunion) occurs commonly as people get older, but may be associated with rheumatoid arthritis.

Paraesthesiae in the feet may have been noticed. Try to find out the distribution of the abnormal sensation, which may be a result of peripheral nerve injury or peripheral neuropathy. Coldness of the feet is very common but cyanosis and ulceration are more worrying problems. Chronic foot ulcers mean diabetes must be excluded.

Examination

This examination includes the ankles, feet and toes.

Look at the skin. Note any swelling, scars, deformity or muscle wasting. Deformities affecting the forefoot include hallux valgus (fixed lateral deviation of the main axis of the big toe), clawing (fixed flexion deformity) and crowding of the toes, as occurs in rheumatoid arthritis. Sausage deformities of the toes occur with psoriatic arthropathy or Reiter's[s] disease (Figure 9.46). Look for the nail changes that suggest psoriasis. Inspect the transverse arch of the foot, which runs underneath the metatarsophalangeal joints, and the longitudinal arch, which runs from the first metatarsophalangeal joint to the heel. These arches, which bear the weight of the body, may be flattened in arthritic conditions of the foot like rheumatoid arthritis. Calluses over the metatarsal heads on the plantar surface of the foot occur with subluxation of these joints (Figure 9.47).

Figure 9.46 Sausage-shaped first and second toes in psoriatic arthritis

Figure 9.47 Rheumatoid feet showing bilateral hallux valgus and calluses over the metatarsal heads

Feel, starting with the ankle, for swelling around the lateral and medial malleoli. This should not be confused with pitting oedema. If an ankle fracture is suspected because of a history of injury, tenderness over the posterior medial malleolus is a reliable sign (positive LR 4.8).[10]

Move the *talar (ankle) joint*, grasping the midfoot with one hand. *Dorsiflexion* is tested by raising the foot towards the knee—normally possible to 20 degrees—and *plantar flexion* by performing the opposite manoeuvre, which is normally possible to 50 degrees.

With the subtalar joint, only *inversion* and *eversion* of the foot on the ankle are tested. Pain on movement is more important than range at this joint. The midtarsal (midfoot) joint allows rotation of the forefoot when the hindfoot is fixed. This is done by steadying the ankle with one hand and rotating (twisting) the forefoot. Again, pain on motion rather than loss of range of movement is noted.

Squeeze the *metatarsophalangeal joints* by compressing the first and fifth metatarsals between your thumb and forefinger. Tenderness suggests inflammation, common in early rheumatoid arthritis. Press upwards from the sole of the foot just proximal to the metatarsophalangeal joints of the third and fourth toes. Pain here suggests *Morton's*[t] neuroma. This is due to entrapment and swelling of the digital nerve between the toes. It is associated with pain and numbness of the sides of these toes.

Each *individual interphalangeal joint* is then assessed by feeling and moving. These are typically affected in the seronegative spondyloarthropathies. Extremely tender involvement of the first metatarsophalangeal joint is characteristic of acute gout. In this case the joint also looks red and swollen.

Palpate the *Achilles tendon* for rheumatoid nodules (Figure 9.48) and tenderness due to Achilles tendinitis. An old Achilles tendon rupture may be detected by squeezing the calf: normally the foot plantar flexes unless the tendon has previously ruptured (Simmonds'[u] test). Also palpate the inferior aspect of the *heel* for tenderness; this may indicate plantar fasciitis, which occurs in the seronegative spondyloarthropathies and sometimes for no apparent reason.

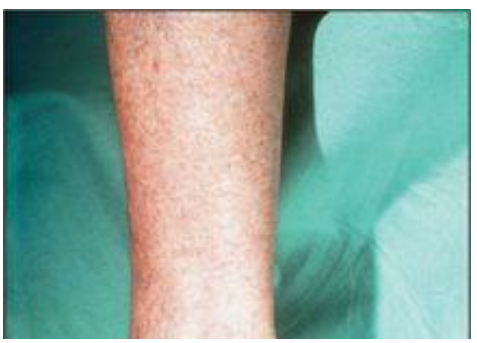


Figure 9.48 Rheumatoid nodule of the Achilles tendon

Correlation of physical signs and rheumatological disease

Rheumatoid arthritis (Figures 9.30 and 9.49)

This is a chronic systemic inflammatory disease of unknown aetiology which characteristically involves the joints. In the majority of cases, patients with rheumatoid arthritis have rheumatoid factor present in the serum (seropositive disease). These are heterogeneous antibodies directed against the Fc portion of immunoglobulin G (IgG), but are not specific for rheumatoid arthritis.

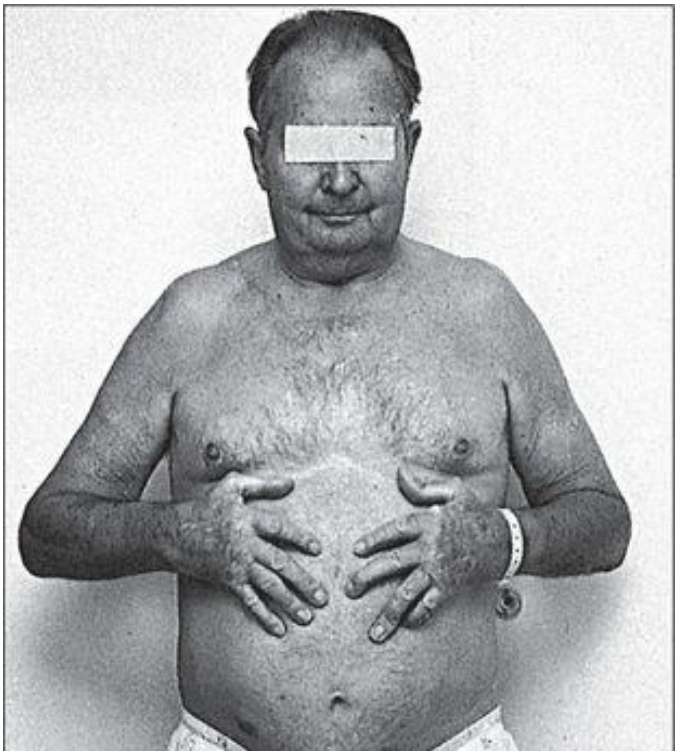


Figure 9.49 Rheumatoid arthritis

1. **General inspection**
   Cushingoid appearance
   Weight

2. **Hands**

3. **Arms**
   Entrapment neuropathy (e.g. carpal tunnel)
   Subcutaneous nodules
   Elbow joint
   Shoulder joint
   Axillary nodes

4. **Face**
   Eyes—dry eyes (Sjögren's), scleritis, episcleritis, scleromalacia perforans, anaemia, cataracts (steroids, chloroquine)
   Fundi—hyperviscosity
   Face—parotids (Sjögren's)
   Mouth—dryness, ulcers, dental caries
   Temporomandibular joint (crepitus)

5. **Neck**
   Cervical spine
   Cervical nodes

6. **Chest**
   Heart—pericarditis, valve lesions
   Lungs—effusion, fibrosis, infarction, infection, nodules (and Caplan's syndrome)

7. **Abdomen**
   Splenomegaly (e.g. Felty's syndrome)
   Inguinal nodes

8. **Hips**

9. **Knees**

10. **Lower limbs**
    Ulceration (vasculitis)
    Calf swelling (ruptured synovial cyst)

Peripheral neuropathy
Mononeuritis multiplex
Cord compression

11. Feet

12. Other
Urine: protein, blood (drugs, vasculitis, amyloidosis)
Rectal examination (blood)

To examine the patient with suspected rheumatoid arthritis, sit him or her up in bed or on a chair.

General inspection

Look to see whether the patient has a Cushingoid appearance due to steroid treatment (page 309), or whether there are signs of weight loss that may indicate active disease.

The hands

Put the hands on a pillow. Look especially for symmetrical small joint synovitis (the distal interphalangeal joints are usually spared). The other common abnormalities are ulnar deviation, volar subluxation of the metacarpophalangeal joints, and Z deformity of the thumb with swan neck and boutonnière deformity of the fingers. Examine the fingernails and periungual areas for splinter-like vasculitic changes and look for wasting of the small muscles of the hand. Look at the palms for palmar erythema. Feel the palms for palmar tendon crepitus while the patient extends and flexes the fingers. Look for signs of an ulnar nerve palsy (from ulnar nerve entrapment at the elbow) and a median nerve palsy (carpal tunnel).

The wrists

Look for synovial thickening and perform Phalen's sign (carpal tunnel).

The elbows

Look around the elbows for rheumatoid nodules, which suggest seropositive disease, and examine the elbow joint. Flexion contractures are common.

disease, and examine the elbow joint. Flexion contractures are common.

The shoulders and axillae

Here examine for tenderness and limitation of movement. Also palpate the axillary nodes because enlarged nodes may indicate active disease of joints in the area that they drain.

The eyes

Look at the eyes for redness which may indicate the dryness of Sjögren's syndrome (Table 9.8), which occurs in 10%–15% of cases. Note also nodular scleritis (an elevated white or purple-red lesion, which is pathologically a rheumatoid nodule and usually appears surrounded by the intense redness of the injected sclera) (Figure 9.50). These nodules occur especially in the superior parts of the sclera and are often bilateral, but affect only 1% of patients. Iritis does *not* occur.

Figure 9.50 Nodular scleritis involving the sclera lateral to the iris

With severe scleritis, scleral thinning may occur, exposing the underlying choroid. This is called *scleromalacia*. Look for cataracts due to steroid treatment. Conjunctival pallor may be present, indicating anaemia due to iron deficiency. This can be a result of blood loss from non-steroidal anti-inflammatory drug use, folate deficiency from a poor diet, hypersplenism or chronic inflammation, or some combination of these.

The parotids

Look for enlargement of the parotid glands, as occurs with Sjögren's syndrome.

syndrome.

The mouth

Look for dryness of the mouth and dental caries (Sjögren's syndrome), and ulcers related to drug treatment (e.g. methotrexate).

The temporomandibular joints

Feel the temporomandibular joints for crepitus as the patient opens and shuts the mouth.

The neck

Go on to examine the cervical spine for tenderness, muscle spasm and reduction of rotational movement. Examine for cervical lymphadenopathy.

The chest

Now examine the lungs for signs of pleural effusions or pulmonary fibrosis. Caplan's syndrome[v] is the presence of rheumatoid lung nodules in combination with pneumoconiosis.

The heart

Listen to the heart for a pericardial rub (relatively common) and for murmurs indicating valvular regurgitation (especially the aortic valve), which may occur due to nodular involvement of a heart valve.

The abdomen

Feel the abdomen for splenomegaly (this occurs in up to 10% of patients and suggests the possibility of Felty's syndrome, page 229) and hepatomegaly. Feel the inguinal lymph nodes.

The lower limbs

Examine the hips for limitation of joint movement. The knees, however, are more often affected and here one must note any quadriceps wasting, synovial

effusions and flexion contractures. Valgus deformity and ligamentous instability may occur as late complications. Look in the popliteal fossae for Baker's cysts. Go on to look at the lower parts of the legs for ulceration; this can occur as a vasculitic complication of Felty's syndrome. Examine for a stocking distribution peripheral neuropathy and for mononeuritis multiplex of the nerves of the lower limbs. There may also be signs of spinal cord compression due to anterior dislocation of the first cervical vertebra or vertical subluxation of the odontoid process.

The ankles and feet (Figures 9.47 and 9.48)

Now look for foot drop (peroneal nerve entrapment or vasculitis) and examine the ankle joint for limitation of movement. Look at the metatarsophalangeal joints for swelling and subluxation. There may also be lateral deviation and clawing of the toes. Remember that the interphalangeal joints are very rarely involved. Finally, feel the Achilles tendon for nodules—a sign of seropositive disease.

Seronegative spondyloarthropathies

Four conditions are generally accepted as belonging to this group: ankylosing spondylitis, psoriatic arthritis, Reiter's disease (reactive arthritis) and enteropathic arthritis. These are called the seronegative spondyloarthropathies because they were originally distinguished from rheumatoid arthritis by the absence of rheumatoid factor in the serum. However, up to 30% of patients with otherwise classical rheumatoid arthritis are rheumatoid factor negative. The seronegative spondyloarthropathies overlap clinically and pathologically, and have an association with HLA-B27.

Ankylosing spondylitis

The following areas should be examined.

The back and sacroiliac joints: may show loss of lumbar lordosis and thoracic kyphosis; severe flexion deformity of the lumbar spine (rare); tenderness of the lumbar vertebrae; reduction of movement of the lumbar spine in all directions; and tenderness of the sacroiliac joints.

The legs: Achilles tendinitis; plantar fasciitis; signs of cauda equina compression (rare)—lower limb weakness, loss of sphincter control, saddle sensory loss.

The lungs: decreased chest expansion (less than 5 cm); signs of apical

fibrosis.

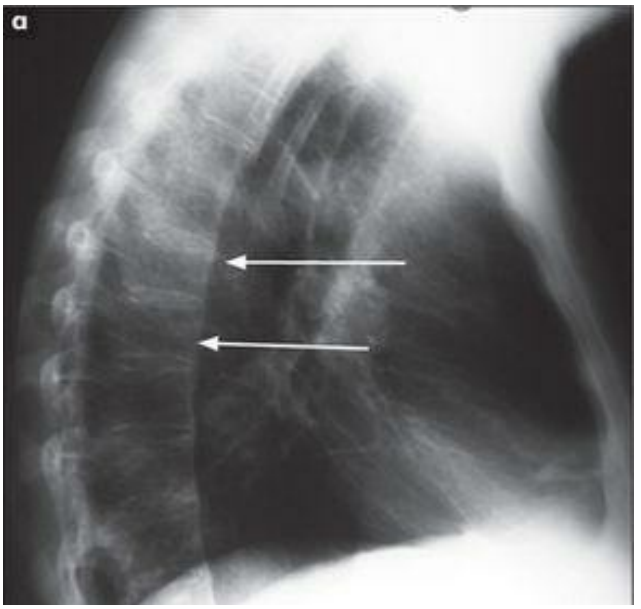
The heart: signs of aortic regurgitation.

The eyes: acute iritis (tends to recur)—painful red eye (10%–15%) (Figure 9.51).

Figure 9.51 Iritis of the right eye

Rectal and stool examination: signs of inflammatory bowel disease (either ulcerative colitis or Crohn's disease). *Note:* signs of secondary amyloidosis—for example, hepatosplenomegaly, renal enlargement, proteinuria—may be present, although this is a very rare complication.

X-rays of the spine and sacroiliac joints (Figure 9.52): may show ankylosis (fusion) of the sacroiliac joints and 'squaring' of the vertebral bodies as a result of loss of their anterior corners and periostitis of their waists. 'Bridging syndesmophytes'[w] occur as a result of ossification of the fibres of the joint annulus. Severe disease causes the changes called *bamboo spine* visible on X-ray.



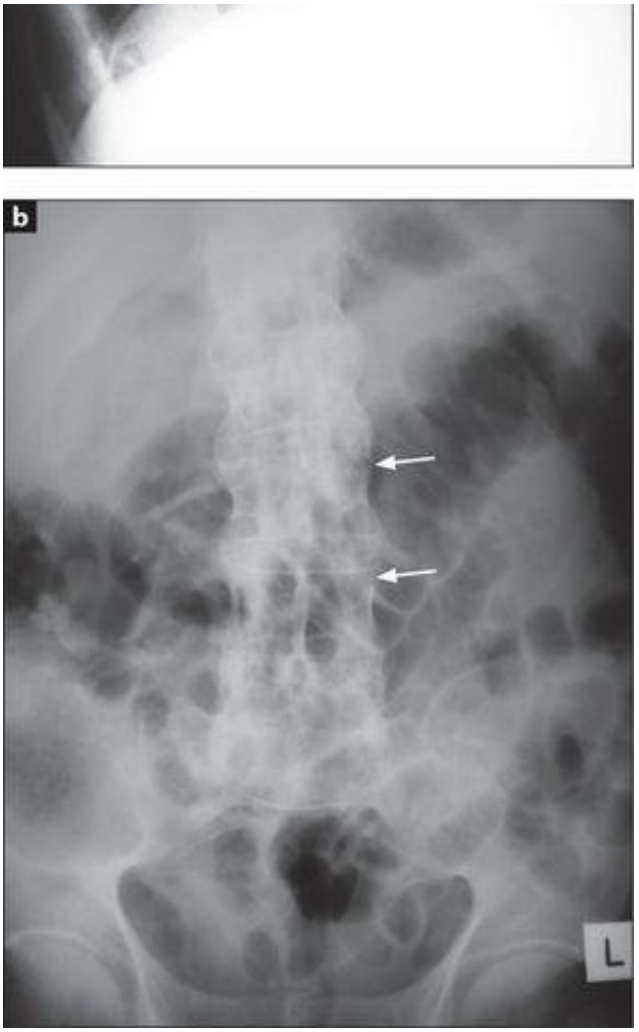


Figure 9.52 Ankylosing spondylitis
Anteroposterior (a) and lateral (b) X-rays of the thoracic spine showing ankylosis of the sacroiliac joints, extensive syndesmophyte formation (short arrows) and squaring of the vertebral bodies (long arrows).

Courtesy Canberra Hospital X-ray library.

Reiter's syndrome (reactive arthritis)

Classically this disease follows urethritis or diarrhoea, with conjunctivitis and arthritis (usually asymmetrical) of the large weightbearing joints such as the hip, knee or ankle. The following areas should be examined.

The genital region: urethral discharge; circinate balanitis—scaly, superficial reddened erosions with well-demarcated borders on the glans penis (Figure 9.53).

Figure 9.53 Circinate balanitis

The prostate: prostatitis.
The eyes: conjunctivitis; iritis (rare).
The mouth: painless smooth mucosal lesions, especially of the tongue.
The back: sacroiliac joints (may be unilaterally involved).
The lower limbs (more commonly affected): knees, ankles; metatarsophalangeal joints and toes ('sausage toes'); plantar fasciitis, Achilles tendinitis; keratoderma blennorrhagica on the sole (non-tender reddish-brown macules, which become scaling papules; Figure 9.54)—this is indistinguishable from pustular psoriasis; nails thickened, opaque and brittle.

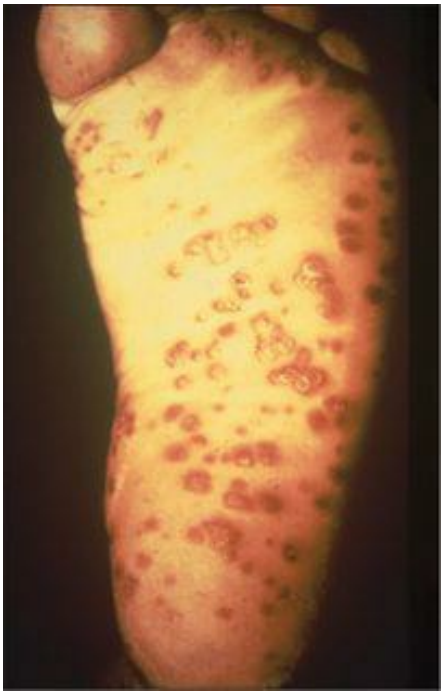


Figure 9.54 Reiter's syndrome with keratoderma blennorrhagica

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The hands (less commonly involved): wrists; metacarpophalangeal

The hands (less commonly involved): wrists, metacarpophalangeal joints, proximal interphalangeal joints, distal interphalangeal joints; keratoderma blennorrhagica on the palms; nail changes.

Cardiovascular system: aortic regurgitation (rare).

X-ray findings: the first attack of arthritis is associated with soft-tissue changes and subsequent attacks may lead to joint-space narrowing and proliferative erosions at the joint margins. Changes in the sacroiliac joints and spine resemble those of ankylosing spondylitis except that the sacroiliac joint changes and spinal syndesmophytes tend to be asymmetrical. Calcaneal spurs (Figure 9.55)—a result of plantar fasciitis—are characteristic.

Figure 9.55 Reiter's syndrome
X-ray of the pelvis of a patient with Reiter's syndrome, showing loss of joint space in the sacroiliac joints (arrows).

Courtesy Canberra Hospital X-ray library.

Psoriatic arthritis

Ten per cent of patients with psoriasis (page 446) have arthritis.

Examine as for rheumatoid arthritis, but include the spine and sacroiliac