indigenous patients. These skills have general application for all cultural groups but vary in detail from one to another.

All of these problems require an especially sensitive approach. You as a clinician need to be impartial and objective. Students may need to discuss specific problems with members of the medical faculty and find out what the university and hospital policies are on these matters.

The 'uncooperative' or 'difficult' patient and the history

Most clinical encounters are a cooperative effort on the part of the patient and clinician. The patient wants help to find out what is wrong and to get better. This should make the meeting satisfying and friendly for both parties. However, interviews do not always run smoothly.[13] Resentment may occur on both sides if the patient seems not to be taking the doctor's advice seriously, or will not cooperate with attempts at history taking or examination. Unless there is a serious psychiatric or neurological problem that impairs the patient's judgment, taking or not taking advice remains his or her prerogative. The clinician's role is to give advice and explanation, not to dictate. Indeed, it must be realised that the advice may not always be correct. Keeping this in mind will help prevent that most unsatisfactory and unprofessional of outcomes—becoming angry with the patient.

This approach, however, must not be an excuse for not providing a proper, sympathetic and thorough explanation of the problem and the consequences of ignoring medical advice, to the extent that the patient will allow. A clinician whose advice is rarely accepted should begin to wonder about his or her clinical acumen.

Patients who are **aggressive and uncooperative** may have a medical reason for their behaviour. The possibilities to be considered include alcohol or drug withdrawal, an intracranial lesion such as a tumour or subdural haematoma, or a psychiatric disease such as paranoid schizophrenia. In other cases, resentment at the occurrence of illness may be the problem.

Some patients may seem difficult because they are **too cooperative**. The patient concerned about his blood pressure may have brought printouts of his own blood pressure measurements at half-hour intervals for several weeks. It is important to show restrained interest in these recordings, without encouraging excessive enthusiasm in the patient. Other patients may bring with them information about their symptoms or a diagnosis obtained from the internet. It is important to remember, and perhaps point out, that information obtained in this way may not have been subjected to any form of peer review. People with chronic illnesses, on the other hand, may know more about their conditions than their medical attendants.

Sometimes the interests of the patient and the doctor are not the same.

This is especially so in cases where there is the possibility of compensation for an illness or injury. These patients may, consciously or unconsciously, attempt to manipulate the encounter. This is a very difficult situation and can be approached only by rigorous application of clinical methods.

Occasionally, attempted manipulation takes the form of flattery or inappropriate personal interest directed at the clinician. This should be dealt with by carefully maintaining professional detachment. The clinician and the patient must be conscious that their meeting is a professional and not a social one.

History taking for the maintenance of good health

There has never been more public awareness of the influence the way people live has on their health. Most people have some understanding of the dangers of smoking, excessive alcohol consumption and obesity. People have more varied views on what constitutes a healthy diet and exercise regime, and many are ignorant of what constitutes risky sexual activity.

Part of the thorough assessment of patients includes obtaining and conveying some idea of what measures may help them maintain good health (*Questions box 2.4*). This includes a comprehensive approach to the combination of risk factors for various diseases, which is much more important than each individual risk factor. For example, advising a patient about the risk of premature cardiovascular disease will involve knowing about the family history, smoking history, previous and current blood pressure, current and historical cholesterol levels, dietary history, assessment for diabetes mellitus and how much exercise the patient undertakes.

Questions box 2.4

Questions related to the maintenance of good health

1. Are you a smoker? When did you stop?
2. Do you know what your cholesterol level is?
3. Do you think you have a healthy diet?
4. Has your blood pressure been high?
5. Have you had diabetes or a raised sugar level?

6. Do you drink alcohol? Every day? How many drinks?

7. Do you do any sort of regular exercise?

8. How much do you weigh? Has your weight changed recently?

9. Do you think you have engaged in any risky sexual activity? What was that?

10. What vaccinations have you had? Include questions about tetanus, influenza, pneumococcal and meningococcal vaccination and *Haemophilus influenzae* (these last three are essential for patients who have had a splenectomy as they are especially vulnerable to infection with these encapsulated organisms), hepatitis A & B, papilloma virus, travel vaccinations

11. Have you had any regular screening for breast cancer or ovarian cancer? (Family history or age over 50 years)

12. Have you had screening for colon cancer screening? What was it? (Age 50+ years or family history of colon cancer or inflammatory bowel disease)

13. Is there a history of inherited diseases, e.g. a family history of sudden death?

Ask about screening tests being done for any serious illnesses, such as mammograms for breast cancer, Pap smears for cervical cancer or colonoscopy for colon cancer.

The first interview with a patient is an opportunity to make an assessment of the known risk factors for a number of important medical conditions. Even when the patient has come about an unconnected problem, there is often the opportunity for a quick review. Constant matter-of-fact reminding about these can make a great difference to the way people protect themselves from ill-health.

The patient's awareness and understanding of these basic measures for maintaining good health can be assessed throughout the interview. Even when they are unrelated to the presenting problem, serious examples of risky behaviour should be pointed out. This should not be done in an aggressive way. For example, you might say: 'This might be a good time to make a big effort to give up smoking, because it's especially unwise for someone like you with a family history of heart disease.'

Certain questions can be helpful in making a diagnosis of alcoholism; these are referred to as the CAGE questions (see Chapter 1). Another approach is to ask, 'Have you ever had a drinking problem?' and 'Did you have your last drink within the last 24 hours?' The patient who answers 'yes' to both questions is likely to be a high-risk drinker.

The patient's vaccination record should be reviewed regularly and

brought up to date when indicated. The dead virus vaccines include influenza and polio (injectable); hepatitis A and B vaccines are recombinant vaccines. Dead bacteria vaccines include the pneumococcal, meningococcal and *H. influenzae* vaccines; tetanus, diphtheria and pertussis are bacterial toxins modified to be non-toxic. The attenuated live-virus vaccines include measles-mumps-rubella (MMR), herpes zoster and influenza (nasal); an attenuated live-bacteria vaccine is bacille Calmette-Guérin (BCG—for tuberculosis). Pregnant women and immunosuppressed people should ***not*** be given attenuated live vaccines. Travel to rural Asia and other exotic places may be an indication for additional vaccinations (e.g. Japanese encephalitis, typhoid).

The elderly patient

Patients who are in their seventies or older present with similar illnesses to younger patients but certain problems are more likely in older patients. History taking should address these potential problems as part of the 'maintenance of good health' aspect of history taking.

Activities of daily living (ADL)

For elderly patients and those with a chronic illness, ask some basic screening questions about **functional activity**.

Ask specific questions about the patient's ability to bathe, walk, use the toilet, eat and dress (ADL). Find out whether the patient needs help to perform these tasks and who provides it. It may be necessary to ask, 'How do you manage?' or 'What do you do about that problem?' Help may come from relatives, neighbours, friends, the health service or charitable organisations. The proximity and availability of these services vary, and more details should be sought. Try to find out whether the patient is happy to accept help or not.

You should also ask questions about the **instrumental activities** of daily living (IADL), such as shopping, cooking and cleaning, the use of transport, and managing money and medications.

Establish whether the patient has ever been assessed by an occupational therapist or whether there has been a 'home visit'. Ask whether alterations been made to the house (e.g. installation of ramps, railings in the bathroom, emergency call buttons, etc.).

Find out who else lives with the patient and how those people seem to be coping with the patient's illness. Obviously, the amount of detail required depends on the severity and chronicity of the patient's illness.

The risk of complications of infections is increased, and most elderly

people should have routine influenza vaccinations—ask if vaccinations are up to date.

Mental state

Ask questions that may help to assess cognitive function. Is there a family history of dementia? Has the patient noticed problems with memory or with aspects of life such as paying bills?

Delirium refers to confusion and altered consciousness. Don't confuse this with *dementia*, where consciousness is not altered but there is progressive loss of long-term memory and other cognitive functions. Perform a mini-mental examination (refer to Chapter 12) and record the score.

Specific problems in the elderly

Falls and loss of balance are common and dangerous for these patients. Hip fractures and head injuries are life-threatening events. Ask about falls and near-falls. Does the patient use a stick or a frame? Are there hazards in the house that increase the risk (e.g. steep and narrow stairs)? The use of sedatives like sleeping tablets or anti-anxiety (anxiolytic) drugs and of some anti-hypertensive drugs increases falls risk and must be assessed.

Screening for osteoporosis is recommended for all women over 65 years and all men 70 and older. Risk factors for osteoporosis include being underweight, heavy alcohol use, use of corticosteroids or early menopause, or a history of previous fractures.

General questions about mobility should also include asking about reasons for immobility. These may include arthritis, obesity, general muscle weakness and proximal muscle weakness (sometimes due to corticosteroid use).

Elderly patients may have strong feelings about the extent of treatment they want if their condition deteriorates. These should be recorded before a deteriorating medical illness makes the patient incapable of expressing his or her wishes. This is a difficult area. If a patient expresses a wish not to have certain treatments, the clinician must make very sure that the nature and likely success of these is understood by the patient. For example, a patient who expresses a wish not to be revived if his or her heart stops after a myocardial infarct may not understand that early ventricular fibrillation is almost always successfully treated by cardioversion without long-term sequelae. Patients' decisions must be *informed* decisions.

Polypharmacy (use of four or more regular medications) is a particular problem for old people. Take a detailed drug history and attempt to find out

problem for old people. Take a detailed drug history and attempt to find out the indications for each of the drugs, and consider possible drug interactions. Find out how the patient manages the medications and whether they seem to be taken accurately. Does the patient use a prepared weekly drug box (a 'Webster pack')?

Evidence-based history taking and differential diagnosis

The principles of evidence-based clinical examination are discussed in the next chapter in more detail, but they also have an application to history taking. The starting point of the differential diagnosis of a certain symptom is the likelihood (or probability) that a certain condition will occur in this person. Most clinicians still rely on their own experience when making this assessment, although some information of disease prevalence in different populations is becoming available. Unfortunately, one person's experience is a relatively small sample, and past experience may bias the clinician in favour of or against a certain diagnosis.

Some diagnoses may largely be excluded from the differential diagnosis list at once. This may be based, for example, on the patient's age, sex or race or the extreme rarity of the disease in a particular country. For example, chronic obstructive pulmonary disease would be very unlikely in a 20-year-old non-smoker who presents with breathlessness.

The differential diagnosis is gradually narrowed as more information about the patient's symptoms comes from the patient directly, and as a result of specific questioning about features of the symptoms that will help to refine the list.

A symptom typical of a certain condition will increase the likelihood of the diagnosis by a certain percentage. If the prevalence of the condition is already high, a high likelihood ratio (LR) should bring that condition towards the top of the differential list. For example, a patient's description of 'typical angina' has a strong LR of 5.8 for the diagnosis of significant coronary artery disease. This would make the diagnosis highly likely in a patient from a population with a high prevalence of coronary disease (e.g. a man over the age of 50 with typical anginal chest pain) but still very unlikely in someone from a very low risk population (e.g. a 19-year-old woman). Likelihood ratios are discussed in more detail in Chapter 3.

The clinical assessment

After the physical examination, the interview with the patient concludes with an assessment by the clinician of what the diagnosis or possible diagnoses

are, in order of probability.[14] This will, not unreasonably, be the most important part of the whole process from the patient's point of view.

The explanation must relate to the patient's symptoms or perception of the problem. The clinician should explain how the symptoms and any examination findings relate to the diagnosis. For example, if a patient presents with dyspnoea, the clinician should begin by saying, 'I believe your shortness of breath is probably the result of pneumonia, but there are a few other possibilities'. The complexity of the explanation will depend on the clinician's understanding of the patient's ability to follow any technical aspects of the diagnosis. The patient's desire for a detailed explanation is also variable, and this must be taken into account.

If the diagnosis is fairly definite, then the prognosis and the implications of this must be outlined. A serious diagnosis must be discussed frankly but always in the context of the variability of outcome for most medical conditions and the benefits of correct treatment. When a patient seems unwilling to accept a serious diagnosis and seems likely to decline treatment, the clinician must attempt to find out the reason for the patient's decision. Have there been previous bad experiences with medical treatment, or has a friend or relative had a similar diagnosis and a difficult time with treatment or complications?

Sometimes blunt language may be justified. For example, 'It is important for you to realise that this is a life-threatening illness which needs urgent treatment.' Patients who seem unable to accept advice of this sort should be offered a chance to discuss the matter with another doctor or with their family. This must be done sympathetically: 'This is obviously a difficult time for you. Would you like me to arrange for you to see someone for another opinion about it? Or would you like to come back with some of your family to talk about it again?' The patient's response should be carefully documented in the notes.

Patients may need to be cautioned about certain activities until the condition is treated. For example, a patient with a possible first epileptic seizure must be told that he or she may not legally drive a motor vehicle.

Concluding the interview

After talking to the patient about the assessment and prognosis, the need for investigations and any urgency involved should be discussed. Admission to hospital may be recommended if the problem is a serious one. This may involve major inconvenience to a patient; the clinician must be ready to justify the recommendation and attempt to predict the likely length of stay. If the investigations are onerous or involve risk, this must also be explained and alternatives discussed, if they are available.

alternatives discussed, if they are available.

If drug treatment is being prescribed, the patient is entitled to know why this is necessary, what it is likely to achieve and what possible important adverse effects might occur. This is a complex topic. On the clinician's part, it requires a comprehensive understanding of drug interactions and adverse effects, as well as an assessment of what it is reasonable to tell a patient without causing alarm or symptoms by suggestion. Patients must at least know what dangerous symptoms should lead to immediate cessation of the drug. Pharmacies often provide patients with long and unedited lists of possible adverse effects when they dispense drugs. Patients may be too frightened to take the prescription unless these are explained at the time of the consultation. Dealing with this difficult area takes time and experience.

There is no shame in telling a patient you will look up possible side-effects and interactions of a drug before you prescribe it or if a patient expresses concern about it. You could say 'I haven't heard of that problem with this drug but let me look it up and check.'

Finally, the patient must be given the opportunity to ask questions. Few people, given a complicated diagnosis, can absorb everything that has been said to them. The patient should be reminded that there will be an opportunity to ask further questions at the next consultation, when the results of tests or the effects of treatment can be assessed.

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Suggested reading

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Chapter 3

The general principles of physical examination

> More mistakes are made from want of a proper examination than for any other reason.
> *Russell John Howard (1875–1942)*

Students beginning their training in physical examination will be surprised at the formal way this examination is taught and performed.[1,2] There are, however, a number of reasons for this formal approach. The first is that it ensures the examination is thorough and that important signs are not overlooked because of a haphazard method.[3] The second is that the most convenient methods of examining patients in bed, and for particular conditions in various other postures, have evolved with time. By convention, patients are usually examined from the right side of the bed, even though this may be more convenient only for right-handed people. When students learn this, they often feel safer standing on the left side of the bed with their colleagues in tutorial groups, but many tutors are aware of this device, particularly when they notice all students standing as far away from the right side of the bed as possible.

It should be pointed out here that there is only limited evidence-based information concerning the validity of clinical signs. Many parts of the physical examination are performed as a matter of tradition. As students develop their examination skills, experience and new evidence-based data will help them refine their use of examination techniques. We have included information about the established usefulness of signs where it is available, but have also included signs that students will be expected to know about despite their unproven value.

For clinical *viva voce* (with live voice) examinations and objective structured clinical examinations (OSCEs), the examiners expect all candidates to have a polished and thorough examination method.

This formal approach to the physical examination leads to the examination of the parts of the body by **body system**. For example, examination of the cardiovascular system, which includes the heart and all the major accessible blood vessels, begins with positioning the patient correctly. This is followed by a quick general inspection and then, rather surprisingly for the uninitiated, seemingly prolonged study of the patient's fingernails. From there, a set series of manoeuvres brings the doctor to the heart. This type of approach applies to all major systems, and is designed to discover peripheral signs of disease in the system under scrutiny. The attention of the examining doctor is directed particularly towards those

attention of the examining doctor is directed particularly towards those systems identified in the history as possibly being diseased, but of course proper physical examination requires that all the systems be examined.

The danger of a systematic approach is that time is not taken to stand back and look at the patient's *general appearance*, which may give many clues to the diagnosis. Doctors must be observant, like a detective (Conan Doyle based his character Sherlock Holmes on an outstanding Scottish surgeon).[4] Taking the time to make an appraisal of the patient's **general appearance**, including the face, hands and body, conveys the impression to the patient (and to the examiners) that the doctor or student is interested in the person as much as the disease. This general appraisal usually occurs at the bedside when patients are in hospital, but for patients seen in the consulting room it should begin as the patient walks into the room and during the history taking, and continue at the start of the physical examination.

Diagnosis has been defined as 'the crucial process that labels patients and classifies their illnesses, that identifies (and sometimes seals) their likely fates or prognoses and that propels us towards specific treatments in the confidence (often unfounded) that they will do more good than harm'.[5]

In normal clinical practice, the detail of the physical examination performed will be 'targeted' and will depend on clues from the history and whether the consultation is a follow-up or new consultation. Students however must know how to perform a complete examination of the body systems even though they will not often perform this in practice (except perhaps during examinations).

First impressions

First impressions of a patient's condition must be deliberately sought; they cannot be passively acquired. Make a conscious point of assessing the patient's general condition right at the start. The specific changes that occur in particular illnesses (e.g. myxoedema) will be discussed in detail in the appropriate chapters. However, certain abnormalities should be obvious to the trained or training doctor.

First, decide how sick the patient seems to be: that is, does he or she look generally ill or well? The cheerful person sitting up in bed reading Proust (Figure 3.1) is unlikely to require urgent attention to save his life. At the other extreme, the patient on the verge of death may be described as *in extremis* or moribund. The patient in this case may be lying still in bed and seem unaware of the surroundings. The face may be sunken and expressionless, respiration may be shallow and laboured; at the end of life, respiration often becomes slow and intermittent, with longer and longer pauses between rattling breaths.

Figure 3.1 'For a long time I used to go to bed early.'

When a patient walks into the consulting room or undresses for the examination, there is an opportunity to look for problems with mobility and breathlessness.

Apart from gaining a general impression of a patient's state of health, certain general physical signs must be sought.

Vital signs

Certain important measurements must be made during the assessment of the patient. These relate primarily to cardiac and respiratory function, and include pulse, blood pressure, temperature and respiratory rate. For example, an increasing respiratory rate has been shown to be an accurate predictor of respiratory failure.[6] Patients in hospital may have continuous ECG and pulse oximetry monitoring on display on a monitor; these measurements may be considered an extension of the physical examination.

The vital signs must be assessed at once if a patient appears unwell. Patients in hospital have these measurements taken regularly and charted. They provide important basic physiological information.

Facies

A specific diagnosis can sometimes be made by inspecting the face, its appearance giving a clue to the likely diagnosis. Other physical signs must

usually be sought to confirm the diagnosis. Some facial characteristics are so typical of certain diseases that they immediately suggest the diagnosis, and are called the **diagnostic facies** (Table 3.1 and Figure 3.2). Apart from these, there are several other important abnormalities that must be looked for in the face.

TABLE 3.1 Some important diagnostic facies

Amiodarone (anti-arrhythmic drug)—deep blue discoloration around malar area and nose
Acromegalic (page 307)
Cushingoid (page 309)
Down syndrome (page 314)
Hippocratic (advanced peritonitis)—eyes are sunken, temples collapsed, nose is pinched with crusts on the lips and the forehead is clammy (page 27)
Marfanoid (page 50)
Mitral (page 57)
Myopathic (page 391)
Myotonic (page 392)
Myxoedematous (prolonged hypothyroidism) (page 305)
Pagetic (page 320)

Pagetic (page 320)
Parkinsonian (page 396)
Ricketic (page 314)
Thyrotoxic (page 302)
Turner’s syndrome (page 314)
Uraemic (page 207)
Virile facies (page 315)

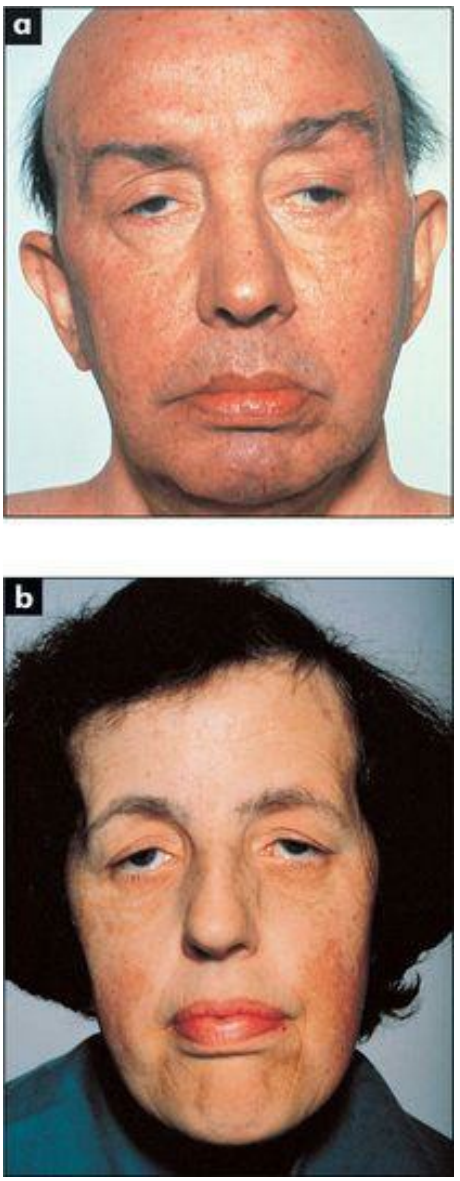

Figure 3.2 Some important diagnostic facies: (a) myopathic; (b) myotonic

From Mir MA, Atlas of Clinical Diagnosis, 2nd edn. Edinburgh: Saunders, 2003, with permission.

Jaundice

When the serum bilirubin level rises to about twice the upper limit of normal, bilirubin is deposited in the tissues of the body. It then causes yellow discoloration of the skin (*jaundice*) and, more dramatically, the apparent discoloration of the sclerae. The usual term *scleral icterus* is misleading, since the bilirubin is actually deposited in the vascular conjunctiva rather than the avascular sclerae. The sclerae (conjunctivae) are rarely affected by other pigment changes. In fact, jaundice is the only condition causing yellow sclerae. Other causes of yellow discoloration of the skin, but where the sclerae remain normal, are carotenaemia (usually due to excess consumption of carotene, often from intemperate eating of carrots or mangoes), acriflavine, fluorescein and picric acid ingestion.

Jaundice may be the result of excess production of bilirubin, usually from excessive destruction of red blood cells (termed haemolytic anaemia), when it can produce a pale lemon-yellow scleral discoloration. Alternatively, jaundice may be due to obstruction to bile flow from the liver, which, if severe, produces a dark yellow or orange tint. Scratch marks may be prominent due to associated itching (pruritus). The other main cause of jaundice is hepatocellular failure. Gilbert's disease is also a common cause of jaundice. It causes a mild elevation of unconjugated bilirubin and is due to an inherited enzyme deficiency that limits bilirubin conjugation; it has a benign prognosis.

Jaundice is discussed in detail in Chapter 6.

Cyanosis

This refers to a blue discoloration of the skin and mucous membranes; it is due to the presence of deoxygenated haemoglobin in superficial blood vessels. The haemoglobin molecule changes colour from blue to red when oxygen is added to it in the lungs. If more than about 50 g/L of deoxygenated haemoglobin is present in the capillary blood, the skin will have a bluish tinge.[7] Cyanosis does *not* occur in anaemic hypoxia because the total haemoglobin content is low. Cyanosis is more easily detected in fluorescent light than in daylight.

Central cyanosis means that there is an abnormal amount of deoxygenated haemoglobin in the arteries and that a blue discoloration is present in parts of the body with a good circulation, such as the tongue. This must be distinguished from *peripheral cyanosis*, which occurs when the blood supply to a certain part of the body is reduced and the tissues extract

more oxygen than normal from the circulating blood: for example, the lips in cold weather are often blue, but the tongue is spared. The presence of central cyanosis should lead one to a careful examination of the cardiovascular (Chapter 4) and respiratory (Chapter 5) systems (see also Table 3.2).

TABLE 3.2 Causes of cyanosis

Central cyanosis 1. Decreased arterial oxygen saturation • Decreased concentration of inspired oxygen: high altitude • Hypoventilation: coma, airway obstruction • Lung disease: chronic obstructive pulmonary disease with cor pulmonale, massive pulmonary embolism • Right-to-left cardiac shunt (cyanotic congenital heart disease) 2. Polycythaemia 3. Haemoglobin abnormalities (rare) • Methaemoglobinaemia • Sulfhaemoglobinaemia
Peripheral cyanosis 1. All causes of central cyanosis cause peripheral cyanosis 2. Exposure to cold 3. Reduced cardiac output: left ventricular failure or shock 4. Arterial or venous obstruction

Pallor

A deficiency of haemoglobin (*anaemia*) can produce pallor of the skin and

A deficiency of haemoglobin (*anaemia*) can produce pallor of the skin and should be noticeable, especially in the mucous membranes of the sclerae if the anaemia is severe (less than 70 g/L of haemoglobin). Pull the lower eyelid down and compare the colour of the anterior part of the palpebral conjunctiva (attached to the inner surface of the eyelid) with the posterior part where it reflects off the sclera. There is usually a marked difference between the red anterior and creamy posterior parts (see Figure 13.3a, page 425). This difference is absent when significant anaemia is present. Although this is at best a crude way of screening for anaemia, it can be specific (though not sensitive) when anaemia is suspected for other reasons as well (*Good signs guide 3.1*). It should be emphasised that pallor is a sign, while anaemia is a diagnosis based on laboratory results.

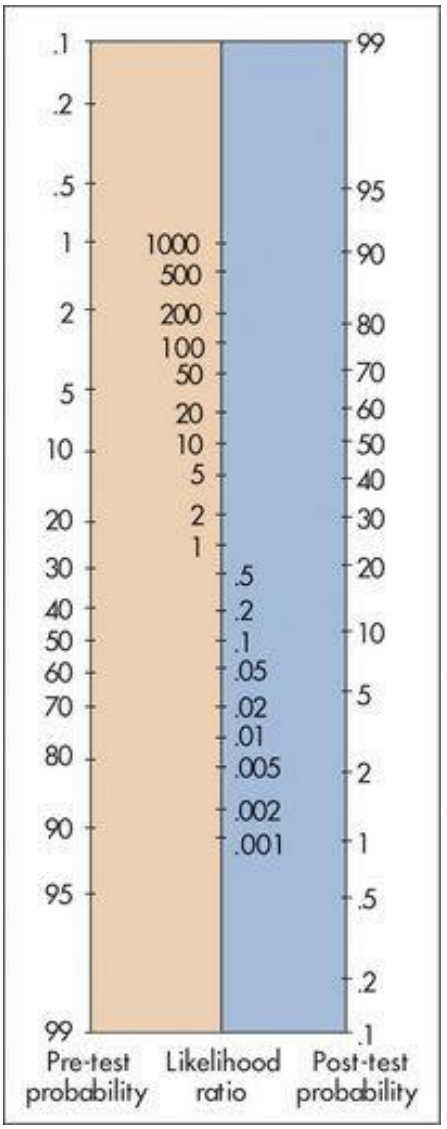

Figure 3.3 Fagan's nomogram for interpreting a diagnostic test result

Adapted from Sackett DL, Richardson WS, Rosenberg W, Haynes RB. Evidence-based medicine: how to practice and teach EBM. Churchill-Livingstone: London, 1997.

Good signs guide 3.1 Anaemia

Sign	Positive LR*	Negative LR†
Pallor at multiple sites	4.5	0.7
Facial pallor	3.8	0.6
Palm crease pallor	7.9	NS
Conjunctival pallor	16.7	–

NS = not significant.

* Positive likelihood ratio: when the finding is *present*, describes the probability change. The higher the LR is above 1, the more likely there is disease.

† Negative likelihood ratio: when the finding is *absent*, describes the probability change. The closer the LR is to 0, the more likely there is *not* disease.

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

Facial pallor may also be found in *shock*, which is usually defined as a reduction of cardiac output such that the oxygen demands of the tissues are not being met (Table 3.3). These patients usually appear clammy and cold and are significantly hypotensive (have low blood pressure) (page 27). Pallor may also be a normal variant due to a deep-lying venous system and opaque skin.

TABLE 3.3 Causes of shock

1. Hypovolaemia • External fluid loss, e.g. blood, vomitus, diarrhoea, urine, burns, excess sweating • Sequestration of body fluids in the abdomen (e.g. ascites), chest (e.g. haemothorax) or limbs (e.g. fracture)
2. Cardiac • Pump failure, e.g. myocardial infarction, acute mitral regurgitation • Cardiac tamponade • Dissecting aortic aneurysm • Arrhythmia
3 Massive pulmonary embolus
4 Sepsis, e.g. gram-negative bacteria (endotoxin)
5 Anaphylaxis
6 Endocrine failure, e.g. adrenal failure, hypothyroidism
7 Neuropathic—from drugs (e.g. antihypertensives, anaesthesia), spinal cord injury of autonomic neuropathy

Hair

Bearded or bald women and hairless men not uncommonly present to doctors. These conditions may be a result of more than the rich normal variations of life, and occasionally are due to endocrine disease (Chapter 10).

Weight, body habitus and posture

Look specifically for obesity. This is most objectively assessed by calculation of the body mass index (BMI), where the weight in kilograms is divided by the height in metres squared. Normal is less than 25°kg/m^2. A BMI of ≥ 30 indicates frank obesity. *Morbid* obesity is a BMI ≥40. Medical risks are increasingly recognised in association with obesity (Table 3.4).

TABLE 3.4 Medical conditions associated with obesity (BMI ≥ 30)

Endocrine
Type 2 diabetes
Amenorrhoea
Dyslipidaemia
Infertility
Polycystic ovary syndrome
Hypogonadism
Respiratory
Sleep apnoea
Dyspnoea
Cardiovascular
Hypertension

Cardiac failure Ischaemic heart disease Cor pulmonale (right heart failure secondary to lung disease) Pulmonary embolism
Musculoskeletal Arthritis Immobility
Skin Skin abscesses Cellulitis Venous stasis Fungal infections
Gut Gastro-oesophageal reflux disease Non-alcoholic steatohepatitis Hernias

There are racial differences in BMIs associated with medical risk. Australian Aboriginals and Asians may have increased medical risk once the BMI exceeds 20.

The waist–hip ratio (WHR) is also predictive of health risk. This measurement is of the circumference of the waist (at the midpoint between the costal margin and the iliac crest) divided by that at the hips (at the widest

the costal margin and the iliac crest) divided by that at the hips (at the widest part around the buttocks). Increased risk occurs when this exceeds 1.0 for men and 0.85 for women. Simple waist measurement correlates with the risks of obesity. A female waist circumference of more than 88 cm or male circumference of more than 102 cm indicates increased risk. These measurements can usefully be made repeatedly and recorded.

Severe underweight (BMI <18.5) is called cachexia.[8] Look for wasting of the muscles, which may be due to neurological or debilitating disease, such as malignancy.

Note excessively short or tall stature, which may be rather difficult to judge when the patient is lying in bed (page 313). Inspect for limb deformity or missing limbs (rather embarrassing if missed in viva voce examinations) and observe if the physique is consistent with the patient's stated chronological age. A number of body shapes are almost diagnostic of different conditions (Table 3.5). If the patient walks into the examining room, the opportunity to examine gait should not be lost: the full testing of gait is described in Chapter 11.

TABLE 3.5 Some body habitus syndromes

Endocrine
Acromegaly (Figure 10.9)
Cushing's syndrome (Figure 10.12)
Hypopituitarism (page 306)
Pseudohypoparathyroidism (Figure 10.14)
Rickets
Paget's disease (Figure 10.24)
Musculoskeletal
Marfan's syndrome (Figure 4.8)

Turner's syndrome

Klinefelter's syndrome (page 316)

Achondroplasia (page 314)

Hydration

Although this is not easy to assess, all doctors must be able to estimate the approximate state of *hydration* of a patient.[9-11] For example, a severely dehydrated patient is at risk of death from developing acute renal failure, while an overhydrated patient may develop pulmonary oedema.

For a traditional assessment of dehydration (Table 3.6), inspect for sunken orbits, dry mucous membranes and the moribund appearance of severe dehydration. Reduced skin turgor (pinch the skin: normal skin returns immediately on being released) occurs in moderate and severe dehydration (this traditional test is not of proven value, especially in the elderly, whose skin may always be like that). The presence of dry axillae increases the likelihood of dehydration and a moist tongue reduces the likelihood, but the other signs are in fact of little proven value (*Good signs guide 3.2*).

TABLE 3.6 Classical physical signs of dehydration (of variable reliability—see *Good signs guide 3.2*)

Mild (<5%): = 2.5 L deficit
Mild thirst
Dry mucous membranes
Concentrated urine
Moderate (5%–8%): = 4 L deficit

As above Moderate thirst Reduced skin turgor (elasticity), especially arms, forehead, chest, abdomen Tachycardia
Severe (9%–12%): = 6 L deficit As above Great thirst Reduced skin turgor and decreased eyeball pressure Collapsed veins, sunken eyes, ‘gaunt’ face Postural hypotension Oliguria (<400 mL urine/24 hours)
Very severe (>12%): >6 L deficit As above Comatose Moribund Signs of shock

Note: Total body water in a man of 70 kg is about 40 L.

Sign	Positive LR	Negative LR
Dry axillae	2.8	NS
Dry mucous membranes; nose and mouth	NS	0.3
Sunken eyes	NS	0.5
Confusion	NS	NS
Speech not clear	NS	0.5

NS = not significant.

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

Take the blood pressure (page 54) and look for a fall in blood pressure when the patient sits or stands up after lying down. The patient should stand, if he or she can, for at least 1 minute before the blood pressure is taken again (the inability of the patient to stand because of postural dizziness is probably a more important sign than the blood pressure difference). This is called *postural hypotension*. An increase in the pulse rate of 30 or more, when the patient stands, is also a sign of *hypovolaemia*.

patient stands, is also a sign of *hypovolaemia*.

Weigh the patient. Following the body weight daily is the best way to determine changes in hydration over time. For example, a 5% decrease in body weight over 24 hours indicates that about 5% of body water has been lost (use the same set of scales).

Assessment of the patient's jugular venous pressure is one of the most sensitive ways of judging intravascular volume overload, or overhydration (see Chapter 4).

The hands and nails

Changes occur in the hands in many different diseases. It is useful as an introduction to shake a patient's hand when meeting him or her. Apart from being polite, this may help make the diagnosis of dystrophia myotonica, a rare muscle disease in which the patient may be unable to let go. Shaking hands is also an acceptable and gentle way of introducing the physical examination. Physical examination is an intrusive event that is tolerated only because of the doctor's (and even the medical student's) professional and cultural standing.

There is probably no subspecialty of internal medicine in which examination of the hands is not rewarding. The shape of the nails may change in some cardiac and respiratory diseases, the whole size of the hand may increase in acromegaly (page 307), gross distortion of the hands' architecture occurs in some forms of arthritis (page 250), tremor or muscle wasting may represent neurological disease (page 354), and pallor of the palmar creases may indicate anaemia (Table 3.7). These and other changes in the hands await you later in the book.

TABLE 3.7 Nail signs in systemic disease

Nail sign	Some causes	Page no.
Blue nails	Cyanosis, Wilson's disease, ochronosis	25
Red nails	Polycythaemia (reddish-blue), carbon monoxide poisoning (cherry-red)	236
Yellow nails	Yellow nail syndrome	132
	Lung cancer, chronic pulmonary suppuration, infective endocarditis,	

Clubbing	suppuration, infective endocarditis, cyanotic heart disease, congenital, HIV infection, chronic inflammatory bowel disease, etc.	50
Splinter haemorrhages	Infective endocarditis, vasculitis	50
Koilonychia (spoon-shaped nails)	Iron deficiency, fungal infection, Raynaud's disease	224
Pale nail bed	Anaemia	224
Onycholysis	Thyrotoxicosis, psoriasis	301
Non-pigmented transverse bands in the nail bed (Beau's lines)	Fever, cachexia, malnutrition	208
Leuconychia (white nails)	Hypoalbuminaemia	159
Transverse opaque white bands (Muehrcke's lines)	Trauma, acute illness, hypoalbuminaemia (also caused by chemotherapy)	208
Single transverse white band (Mees' lines)	Arsenic poisoning, renal failure (also caused by chemotherapy or severe illness)	208
Nailfold erythema and telangiectasia	Systemic lupus erythematosus	282
'Half and half nails' (proximal portion white to pink and distal portion red or brown: Terry's nails)	Chronic renal failure, cirrhosis	208

Temperature

The temperature should always be recorded as part of the initial clinical examination of the patient. The normal temperature (in the mouth) ranges from 36.6°C to 37.2°C (98°F to 99°F) (Table 3.8). The rectal temperature is

normally higher and the axillary and tympanic temperature lower than the oral temperature (Table 3.8). In very hot weather the temperature may rise by up to 0.5°C. Patients who report they have a fever are usually correct, as is a mother who reports that her child's forehead is warm and that fever is present (*Good signs guide 3.3*).

TABLE 3.8 Average temperature values

	Normal	Fever
Mouth	36.8°C	>37.3°C
Axilla*	36.4°C	>36.9°C
Rectum	37.3°C	>37.7°C

* Tympanic temperatures are similar to axillary ones.

Good signs guide 3.3 Fever

Sign	Positive LR	Negative LR
Patient says has fever	4.9	0.2
Warm forehead	2.5	0.4

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

There is a diurnal variation; body temperature is lowest in the morning and reaches a peak between 6.00 and 10.00 p.m. The febrile pattern of most diseases follows this diurnal variation. The pattern of the fever (pyrexia) may be helpful in diagnosis (Table 3.9).

TABLE 3.9 Types of fever

Type	Character	Examples
Continued	Does not remit	Typhoid fever, typhus, drug fever, malignant hyperthermia
	Temperature	

Intermittent	Temperature falls to normal each day	Pyogenic infections, lymphomas, miliary tuberculosis
Remittent	Daily fluctuations >2°C, temperature does not return to normal	Not characteristic of any particular disease
Relapsing	Temperature returns to normal for days before rising again	Malaria:
		Tertian—3-day pattern, fever peaks every other day (*Plasmodium vivax, P. ovale*); Quartan—4-day pattern, fever peaks every 3rd day (*P. malariae*)
		Lymphoma:
		Pel-Ebstein* fever of Hodgkin's disease (very rare)
		Pyogenic infection

Note: The use of antipyretic and antibiotic drugs has made these patterns unusual today.

* Pieter Pel (1859–1919), Professor of Medicine, Amsterdam; Wilhelm Ebstein (1836–1912), German physician

Very high temperatures (*hyperpyrexia*, defined as above 41.6°C) are a serious problem and may result in death. The causes include heat stroke from exposure or excessive exertion (e.g. in marathon runners), malignant hyperthermia (a group of genetically determined disorders in which hyperpyrexia occurs in response to various anaesthetic agents [e.g. halothane] or muscle relaxants [e.g. suxamethonium]), the neuroleptic malignant syndrome, and hypothalamic disease.

Hypothermia is defined as a temperature of less than 35°C. Normal thermometers do not record below 35°C and therefore special low-reading thermometers must be used if hypothermia is suspected. Causes of

thermometers must be used if hypothermia is suspected. Causes of hypothermia include hypothyroidism and prolonged exposure to cold (page 304).

Smell

Certain medical conditions are associated with a characteristic odour.[12] These include the sickly sweet acetone smell of the breath of patients with ketoacidosis, the sweet smell of the breath in patients with liver failure, the ammoniacal fish breath ('uraemic fetor') of kidney failure and, of course, the stale cigarette smell of the patient who smokes. This smell will be on his or her clothes and even on the referral letter kept in a bag or pocket next to a packet of cigarettes. The recent consumption of alcoholic drinks may be obvious and 'bad breath', although often of uncertain cause, may be related to poor dental hygiene, gingivitis (infection of the gums) or nasopharyngeal tumours. Chronic suppurative infections of the lung can make the breath and saliva foul-smelling. Skin abscesses may be very offensive, especially if caused by anaerobic organisms or *Pseudomonas* spp. Urinary incontinence is associated with the characteristic smell of stale urine, which is often more offensive if the patient has a urinary tract infection. The smell of bacterial vaginosis is usually just described as offensive. Severe bowel obstruction and the rare gastrocolic fistula can cause faecal contamination of the breath when the patient belches. The black faeces (*melaena*) caused by gastric bleeding and the breakdown of blood in the gut has a strong smell, familiar to anyone who has worked in a ward for patients with gastrointestinal illnesses. The metallic smell of fresh blood, sometimes detectable during invasive cardiological procedures, is very mild by comparison.

Preparing the patient for examination

An accurate physical examination is best performed when the examining conditions are ideal. This means that, if possible, the patient should be in a well-lit room (preferably daylight) from which distracting noises and interruptions have been excluded (rarely possible in busy hospital wards). Screens must be drawn around patients before they are examined. Consulting rooms and outpatient clinics should be set up to ensure privacy and comfort for patients.

Patients have a right to expect that students and doctors will have washed their hands or rubbed them with anti-microbial hand sanitisers before they perform an examination. This is as important in clinics and surgeries as in hospital wards. Many hospitals now have notices telling patients that they

may ask their doctors if their hands have been washed.

The examination should not begin until permission has been asked of the patient and the nature of the examination has been explained.

The patient must be undressed so that the parts to be examined are accessible. Modesty requires that a woman's breasts be covered temporarily with a towel or sheet while other parts of the body are being examined. Male doctors and students should be accompanied by a female *chaperone* when they examine a woman's pelvis, rectum or breasts. Both men and women should have the groin covered—for example, during the examination of the legs. Outpatients should be provided with a gown to wear. However, important physical signs will be missed in some patients if excessive attention is paid to modesty.

The position of the patient in bed or elsewhere should depend on what system is to be examined. For example, a patient's abdomen is best examined if he or she lies flat with one pillow placed so that the abdominal muscles are relaxed. This is discussed in detail in subsequent chapters.

Within each of the examining systems, four elements comprise the main parts of the physical examination: looking—*inspection*; feeling—*palpation*; tapping—*percussion*; and listening—*auscultation*. For many systems a fifth element, *assessment of function*, is added. *Measuring* is also relevant in some systems. Each of these will be discussed in detail in the following chapters.

Evidence-based clinical examination

History taking and physical examination are latecomers to evidence-based medicine. There are big efforts in all areas of medicine to base practice on evidence of benefit.

By their nature, physical signs tend to be subjective and one examiner will not always agree with another. For example, the loudness of a murmur or the presence or absence of fingernail changes may be controversial. There are often different accepted methods of assessing the presence or absence of a sign, and experienced clinicians will often disagree about whether, for example, the apex beat is in the normal position or not. Even apparently objective measurements such as the blood pressure can vary depending on whether Korotkov sound IV or V (page 55) is used, and from minute to minute for the same patient. Some physical signs are present only intermittently; the pericardial rub may disappear before students can be found in the games room to come and listen to it.

A way of looking at the usefulness of a sign or a test is to measure or estimate its *specificity* and *sensitivity*.

• The specificity of a sign is the proportion of people *without* the disease who do *not* have the sign ('negative in health').[5] For example, an 80% specificity means that 8 out of 10 people *without* that sign *do not have* the condition.

• The sensitivity of a sign is the proportion of people *with* the disease who *have* the sign—that is, those who are correctly identified by the test ('positive in disease').[5] A sensitivity of 80% means that assessment of the presence of that sign will pick up 80% of people with the condition (but will not pick up 20%).

You may find it helpful to use the following mnemonics to help you remember this: **SpIn** = ***S****pecific* tests when ***p****ositive* help to rule ***In*** disease and **SnOut** = ***S****ensitive* tests when ***n****egative* help rule ***Out*** disease.

The perfect test or sign (if there were such a thing) is 100% sensitive and specific. A sign or test that is present or 'positive' in a person who does not have the condition is called a *false positive*. The absence of a sign, or a negative test, in a patient who has the condition is called a *false negative*. Another way of looking at this is the positive or negative predictive value of a test—that is, the probability that a positive result means the condition is present or that a negative result means it is absent.

The likelihood that a test or sign result will be a true positive or negative depends on the pre-test probability of the presence of the condition. For example, if splinter haemorrhages (page 50) are found in the nails of a well manual labourer they are likely to represent a false positive sign of infective endocarditis. This sign is not very sensitive or specific and in this case the pre-test probability of the condition is low. If splinters are found in a sick patient with known valvular heart disease and a new murmur, the sign is likely to be a true positive in this patient with a high pre-test probability of endocarditis. This pre-test probability analysis of the false and true positive rate is based on Bayes' theorem.

A useful way to look at sensitivity and specificity is the **likelihood ratio** (LR). A positive LR,

$$\text{Positive LR} = \frac{\text{sensitivity}}{1-\text{specificity}}$$

indicates that the presence of a sign is likely to occur that much more often in an individual with the disease than in one without it. The higher the positive LR, the more useful is a positive sign. A negative likelihood ratio increases the likelihood that the disease is absent if the sign is not present.

$$\text{Nagative LR} = \frac{1-\text{sensitivity}}{\text{specificity}}$$

Remember that if the LR is greater than 1 there is an increased probability of disease; if the LR is less than 1 there is a decreased probability of disease.

For example, the presence of a third heart sound in a patient who might have heart failure (e.g. breathlessness on exertion) has a positive likelihood ratio of 3.8 and a negative LR around 1. This means that a third heart sound is specific for heart failure (increases likelihood of the condition nearly four times) but not sensitive (the absence of a third heart sound does not reduce the likelihood).

All these figures are calculated on a population suspected of disease; it would be quite incorrect to apply them to an asymptomatic group of people. Fagan's nomogram (Figure 3.3) can be used to apply LRs to clinical problems if the pre-test probability of the condition is known or can be estimated. Remember, positive LRs of 2, 5 and 10 increase the probability of disease by 15%, 30% and 45%, respectively. Similarly, negative LRs of 0.5, 0.2 and 0.1 decrease the probability of disease by 15%, 30% and 45% respectively.

When the pre-test probability is very low, even a high positive LR does not make the disease very likely. A line is drawn from the pre-test probability number through the known LR and ends up on the post-test probability number. For example, if the pre-test probability of the condition is low, say 10 (10%) and a sign is present which has an LR of 2, the post-test probability of the condition being present is only about 20%. We have included the LRs in tables of *Good signs guides* in most chapters of this book.

Inter-observer agreement (reliability) and the κ-statistic

The LR of a sign assumes that the sign is present but there is considerable variability in the agreement between observers about the presence of many signs. There are a number of reasons for this low reliability (Table 3.10).

TABLE 3.10 Important reasons for inter-observer disagreement

1 The sign comes and goes; e.g. basal crackles in heart failure, a fourth heart sound
2 Some of the observers' technique may be imperfect; e.g. not

asking the patient to cough before declaring the presence of lung crackles consistent with heart failure
3 Some signs are intrinsically subjective; e.g. the grading of the loudness of a murmur
4 Preconceptions about the patient based on other observations or the history may influence the observer; e.g. goitre may seem readily palpable when a patient is known to have thyroid disease
5 The examination conditions may not be ideal; e.g. attempting to listen to the heart in a noisy clinic when the patient is sitting in a chair and not properly undressed

The κ (kappa) statistic is a way of expressing the inter-observer variation for a sign or test. Values are between 0 and 1, where 0 means the agreement about the sign is the same as it would be by chance and 1 means complete (100%) agreement. Occasionally values of less than 0 are obtained when inter-observer agreement is worse than should occur by chance. By convention a κ-value of 0.8 to 1 means almost or perfect agreement, 0.6 to 0.8 substantial agreement, 0.2 to 0.4 fair agreement, and 0 to 0.2 slight agreement. A selection of signs and their κ-values is listed in Table 3.11. Remember that a high κ-value means agreement about the presence of a sign, *not* that the sign necessarily has a high LR. A low κ-value may be an indication that the sign is a difficult one to elicit accurately, especially for beginners, but it does not always mean that the sign is not useful.

TABLE 3.11 Selected signs and their kappa (κ) values

	κ-value		κ-value
Skin		**Heart**	
Jaundice	0.65	Third heart sound	−0.17–+0.75
Cyanosis	0.36–0.70	Systolic murmur present or absent; >2/6	0.19; 0.59
Palmar erythema	0.37–0.49	Abdominojugular test	0.92
Hydration		Neck veins elevated or normal	0.38–0.69
Axillary dryness	0.50	**Abdomen**	
Patient appears dehydrated	0.44–0.53	Abdominal distension	0.35–0.42
Vital signs		Ascites	0.63–0.75
Tachycardia (>100/min)	0.85	Guarding	0.36–0.49
Bradycardia (<60/min)	0.87	Palpable spleen	0.33–0.75
Tachypnoea	0.25–0.60	Palpable liver edge	0.44–0.53
Goitre	0.38–0.77	Liver span by percussion > 9cm	0.11
Lungs		**Extremities**	

Clubbing	0.33–0.45	Peripheral pulse present or absent	0.52–0.92
Displaced trachea	0.01	Peripheral pulse normal or reduced	0.01–0.15
Decreased tactile fremitus	0.24	Oedema	0.39
Increased tactile fremitus	0.01	Shoulder: painful arc	0.64
Hyper-resonant percussion note	0.26–0.50	**Knee**	
Dull percussion note	0.16–0.52	Effusion	0.28–0.59
Reduced breath sounds	0.16–0.51	McMurray's sign	0.16–0.35
Bronchial breathing	0.19–0.32	**Neurological**	
Crackles	0.21–0.63	Pharyngeal sensation present or absent	1.0
Wheezes	0.43–0.93	Facial weakness present or absent	0.47
Pleural rub	0.51	Dysarthria present or absent	0.61–0.77
Forced expiratory time	0.27–0.70	Muscle strength (MRC scale)	0.69–0.93
Hoover's sign	0.74	Light touch sensation normal, increased or reduced	0.63
		Vibration sense normal, increased or diminished	0.45–0.54

Adapted with permission from McGee S, *Evidence-based physical diagnosis*, 2nd edn. St Louis: Saunders, 2007.

Although some of these values appear low, κ-values for the reporting of a number of diagnostic tests have also been calculated and are not much more impressive—e.g. the reporting of cardiomegaly on a chest X-ray is 0.48, while cholestasis reported on a liver biopsy is 0.40.

In medical practice, multiple factors are taken into account when diagnostic decisions are made. Only very rarely is one symptom or sign or test diagnostic of a condition. The evidence supporting the usefulness of most signs is based on looking at the sign in isolation. It is much more difficult to study the combined importance of the range of historical and physical findings that are present. However, the skilled and experienced clinician uses many pieces of information and is sceptical when an unexpected or illogical finding or test result is obtained.

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Chapter 4

The cardiovascular system

> The heart … moves of itself and does not stop unless for ever.
> *Leonardo da Vinci (1452–1519)*

This chapter deals with the history and the examination of the heart and blood vessels, as well as other parts of the body where symptoms and signs of heart disease may appear. Not only is this fundamental to the assessment of any patient, but it is also an extremely common system tested in viva voce examinations. It is believed by cardiologists to be the most important system in the body.

The cardiovascular history

Presenting symptoms (Table 4.1)

Chest pain

The mention of chest pain by a patient tends to provoke more urgent attention than other symptoms. The surprised patient may find himself

whisked into an emergency ward with the rapid appearance of worried-looking doctors. This is because ischaemic heart disease, which may be a life-threatening condition, often presents in this manner (Table 4.2). The pain of *angina* and *myocardial infarction* tends to be similar in character; it may be due to the accumulation of metabolites from ischaemic muscle following complete or partial obstruction of a coronary artery, leading to stimulation of the cardiac sympathetic nerves.[1,2] Patients with cardiac transplants who develop coronary disease in the transplanted heart may not feel angina, presumably because the heart is denervated. Similarly, patients with diabetes are more likely to be diagnosed with 'silent infarcts'.

TABLE 4.1 Cardiovascular history

Major symptoms
Chest pain or heaviness
Dyspnoea: exertional (note degree of exercise necessary), orthopnoea, paroxysmal nocturnal dyspnoea
Ankle swelling
Palpitations
Syncope
Intermittent claudication
Fatigue
Past history
History of ischaemic heart disease: myocardial infarction, coronary artery bypass grafting
Rheumatic fever, chorea, sexually transmitted disease, recent dental work, thyroid disease
Prior medical examination revealing heart disease (e.g. military, school, insurance)
Drugs
Social history
Tobacco and alcohol use
Occupation
Family history
Myocardial infarcts, cardiomyopathy, congenital heart disease, mitral valve prolapse, Marfan's syndrome
Coronary artery disease risk factors
Previous coronary disease
Smoking
Hypertension
Hyperlipidaemia
Family history of coronary artery disease
Diabetes mellitus

Obesity and physical inactivity
Male sex and advanced age
Raised homocysteine levels
Functional status in established heart disease
Class I—disease present but no symptoms, or angina* or dyspnoea† during unusually intense activity
Class II—angina or dyspnoea during ordinary activity
Class III—angina or dyspnoea during less than ordinary activity
Class IV—angina or dyspnoea at rest

* Canadian Cardiovascular Society (CCVS) classification.

† New York Heart Association (NYHA) classification.

TABLE 4.2 Causes (differential diagnosis) of chest pain and typical features

Pain	Causes	Typical features
Cardiac pain	Myocardial ischaemia or infarction	Central, tight or heavy; may radiate to the jaw or left arm
	Aortic	Very sudden onset, radiates to

Vascular pain	dissection	the back
	Aortic aneurysm	
Pleuropericardial pain	Pericarditis +/− myocarditis	Pleuritic pain, worse when patient lies down
	Infective pleurisy	Pleuritic pain
	Pneumothorax	Sudden onset, sharp, associated with dyspnoea
	Pneumonia	Often pleuritic, associated with fever and dyspnoea
	Autoimmune disease	Pleuritic pain
	Mesothelioma	Severe and constant
	Metastatic tumour	Severe and constant, localised
Chest wall pain	Persistent cough	Worse with movement, chest wall tender
	Muscular strains	Worse with movement, chest wall tender
	Intercostal myositis	Sharp, localised, worse with movement
	Thoracic zoster	Severe, follows nerve root distribution, precedes rash
	Coxsackie B virus infection	Pleuritic pain
	Thoracic nerve compression or infiltration	Follows nerve root distribution
	Rib fracture	History of trauma, localised tenderness
	Rib tumour,	

	primary or metastatic	Constant, severe, localised
	Tietze's syndrome	Costal cartilage tender
Gastrointestinal pain	Gastro-oesophageal reflux	Not related to exertion, may be worse when patient lies down—common
	Diffuse oesophageal spasm	Associated with dysphagia
Airway pain	Tracheitis	Pain in throat, breathing painful
	Central bronchial carcinoma	
	Inhaled foreign body	
Other causes	Panic attacks	Often preceded by anxiety, associated with breathlessness and hyperventilation
Mediastinal pain	Mediastinitis	
	Sarcoid adenopathy, lymphoma	

To help determine the cause of chest pain, it is important to ascertain the duration, location, quality, and precipitating and aggravating factors (the **four cardinal features**), as well as means of relief and accompanying symptoms (the SOCRATES questions; see Chapter 1).[3]

The term **angina**[a] was coined by Heberden from the Greek and Latin words meaning 'choking' or strangling; and the patient may complain of crushing pain, heaviness, discomfort or a choking sensation in the retrosternal area or in the throat. It is best to ask if the patient experiences chest 'discomfort' rather than 'pain', because angina is often dull and aching in character and may not be perceived as pain.

character and may not be perceived as pain.

The pain or discomfort is usually central rather

Questions box 4.1

Questions to ask the patient with suspected angina

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

1. Can you tell me what the pain or discomfort is like? Is it sharp or dull, heavy or tight?

2. When do you get the pain? Does it come out of the blue, or come on when you do physical things? Is it worse if you exercise after eating?

3. How long does it last?

4. Where do you feel it?

5. Does it make you stop or slow down?

6. Does it go away quickly when you stop exercising?

7. Is it coming on with less effort or at rest?—Unstable symptoms

8. Have you had angina before, and is this the same?

than left-sided. The patient may dismiss his or her pain as non-cardiac because it is not felt over the heart on the left side. It may radiate to the jaw or to the arms, but very rarely travels below the umbilicus. The severity of the pain varies.

Angina characteristically occurs with exertion, with rapid relief once the patient rests or slows down. The amount of exertion necessary to produce the pain may be predictable to the patient. A change in the pattern of onset of previously stable angina must be taken very seriously.

These features constitute *typical angina* (Table 4.3).[4] Although angina typically occurs on exertion, it may also occur at rest or wake a patient from sleep. Ischaemic chest pain is usually unaffected by respiration. The use of sublingual nitrates characteristically brings relief within a couple of minutes, but this is not specific as nitrates may also relieve oesophageal spasm and also have a pronounced placebo effect.

TABLE 4.3 Clinical classification of angina from the European Society of Cardiology

Typical angina	Meets all 3 of the following characteristics: 1. Characteristic retrosternal chest discomfort—typical quality and duration 2. Provoked by exertion or emotion 3. Relieved by rest or GTN (glyceryl trinitrate) or both
Atypical angina	Meets 2 of the above characteristics
Non-cardiac chest pain	Meets 1 or none of the above characteristics

The pain associated with an acute coronary syndrome (myocardial infarction or unstable angina) often comes on at rest, is usually more severe and lasts much longer. Acute coronary syndromes are usually caused by the rupture of a coronary artery plaque which leads to the formation of thrombus in the arterial lumen. Stable exertional angina is a result of a fixed coronary narrowing. Pain present for more than half an hour is more likely to be due to an acute coronary syndrome than to stable angina, but pain present continuously for many days is unlikely to be either. Associated symptoms of myocardial infarction include dyspnoea, sweating, anxiety, nausea and faintness.

Other causes of retrosternal pain are listed in Table 4.2. Chest pain made worse by inspiration is called *pleuritic pain*. This may be due to pleurisy (page 110) or pericarditis (page 78). Pleurisy may occur because of inflammation of the pleura as a primary problem (usually due to viral infection), or secondary to pneumonia or pulmonary embolism. Pleuritic pain is not usually brought on by exertion and is often relieved by sitting up and leaning forwards. It is caused by the movement of inflamed pleural or pericardial surfaces on one another.

Chest wall pain is usually localised to a small area of the chest wall, is

sharp and is associated with respiration or movement of the shoulders rather than with exertion. It may last only a few seconds or be present for prolonged periods. Disease of the *cervical or upper thoracic spine* may also cause pain associated with movement. This pain tends to radiate around from the back towards the front of the chest.

Pain due to a *dissecting aneurysm* of the aorta is usually very severe and may be described as tearing. This pain is usually greatest at the moment of onset and radiates to the back. These three features—quality, rapid onset and radiation—are very specific for aortic dissection. A proximal dissection causes anterior chest pain and involvement of the descending aorta causes interscapular pain. A history of hypertension or of a connective tissue disorder such as Marfan's syndrome or Ehlers-Danlos syndrome puts the patient at increased risk of this condition.

Massive pulmonary embolism causes pain of very sudden onset which may be retrosternal and associated with collapse, dyspnoea and cyanosis

Table 4.4a Differential diagnosis of chest pain

Favours angina	Favours pericarditis or pleurisy	Favours oesophageal pain

Tight or heavy	Sharp or stabbing	Burning
Onset predictable with exertion	Not exertional	Not exertional
Relieved by rest	Present at rest	Present at rest
Relieved rapidly by nitrates	Unaffected	Unaffected unless spasm
Not positional	Worse supine (pericarditis)	Onset may be when supine
Not affected by respiration	Worse with respiration	Unaffected by respiration
	Pericardial or pleural rub	

(page 136). It is often pleuritic, but can be identical to anginal pain, especially if associated with right ventricular ischaemia.

Spontaneous pneumothorax may result in pain and severe dyspnoea (page 132). The pain is sharp and localised to one part of the chest.

Gastro-oesophageal reflux can quite commonly cause angina-like pain without heartburn. It is important to remember that these two relatively common conditions may co-exist. *Oesophageal spasm* may cause retrosternal chest pain or discomfort and can be quite difficult to distinguish from angina, but is rare. The pain may come on after eating or drinking hot or cold fluids, may be associated with dysphagia (difficulty swallowing) and may be relieved by nitrates.

Cholecystitis can cause chest pain and be confused with myocardial infarction. Right upper quadrant abdominal tenderness is usually present (page 170).

The cause of severe, usually unilateral, chest pain may not be apparent until the typical vesicular rash of *herpes zoster* appears in a thoracic nerve root distribution.

Dyspnoea

Shortness of breath may be due to cardiac disease. Dyspnoea (Greek *dys* 'bad', *pnoia* 'breathing') is often defined as an unexpected awareness of breathing. It occurs whenever the work of breathing is excessive, but the mechanism is uncertain. It is probably due to a sensation of increased force required of the respiratory muscles to produce a

Table 4.4b Differential diagnosis of chest pain

Favours myocardial infarction (acute coronary syndrome)	**Favours angina**
Onset at rest	Onset with exertion
May be severe	Less severe
Sweating	No sweating