clinical examination essentials

An Introduction to Clinical Skills (and how to pass your clinical exams)

4TH EDITION
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Medicine is a profession that requires an understanding of and an aptitude for science, but also has strong historical and current links to the humanities, and a need to be an excellent and compassionate communicator. This breadth of knowledge and skill is acquired during a long period of training and results in a profession that is always rated by opinion polls as being one of the most respected of all of the professional groups.

Part of the art of medicine is the ability that a competent doctor has to take a concise but comprehensive history, to examine a patient efficiently and proficiently, and to form a differential diagnosis. The education and training needed to develop these skills is complex and requires aptitude and dedication from students and trainees.

A book like this one, which provides a how-to guide to support the next generation of doctors, is an essential toolkit for the doctor in training. Learning clinical skills is the beginning of a fulfilling and wonderful career as a medical professional. These days, being a doctor can be tough, as the increasing needs of patients with multiple problems become more difficult to deal with and the rapid expansion of medical knowledge is more difficult to keep up with. Becoming as proficient as possible in the practice of your clinical skills will help to make you as good a doctor as it is possible to be.

Professor Jane Dacre
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It is much simpler to buy books than to read them and easier to read them than to absorb their contents.

Sir William Osler (1849–1919)

This fourth edition of *clinical examination essentials* has been written to assist medical students to begin their clinical journey and attain competence in history taking and physical examination. We have also included material that more experienced medical students will want to refer to again and again as they practise their clinical skills and prepare for their barrier clinical examinations.

Clinical examinations often seem an artificial way to test students’ knowledge. Taking a history from or performing an examination of a patient while being watched by examiners is very challenging and stressful. However, the more the techniques of history taking and examination are practised, the less difficult it becomes to perform them under observation—they become second nature. This, we believe, is the main point of clinical exams: they force you to spend considerable time seeing patients so that you can practise and become familiar with these essential aspects of medical practice. On the journey towards clinical competence, history taking and physical examination are essential skills for all doctors.

This book sets out approaches to history taking and examination techniques for those students learning these skills for the first time as well as for those revising before their clinical exams. The book is meant to be a guide and it is important that you develop your own approach. We emphasise in this book the need to practise and observe: medicine is not learned from the
computer or phone screen, or from the written page, but by meeting and examining real people who deserve our deep respect and who trust us to put their best interests before our own, as we must. Examiners can soon tell which students have learned to think and act like a doctor.

We have included examination hint boxes throughout the text. These emphasise particular points likely to be useful during the OSCEs (objective structured clinical examinations) and other examinations. The book is not a substitute for hard work on the wards: to become competent, you must talk to and examine as many patients as possible during your clinical rotations. You will learn most from your interactions with patients. There is no single correct way to assess patients on the wards or during clinical exams but there are obvious mistakes to avoid and techniques that work, as we point out in the pages that follow.

Advances in technology are stunning, but even today in about 80% of cases the diagnosis of a medical condition is made, or strongly suspected, on the basis of the history and examination. Accurate diagnosis is so important because treatment usually flows from it; an incorrectly taken history that leads to a wrong diagnosis can (and does) lead to harm. Tests ordered for the wrong reasons, because the patient's story has not been properly obtained, are often useless—or worse, dangerous.

In this edition we have included clinical photographs that have largely replaced line drawings in order to communicate more clearly the key information and illustrate key physical signs. Anatomical information, including surface anatomy, is included because anatomy is the foundation of correct physical examination—you must know what is normal and what structures underlie each part of the body to appreciate abnormalities.

There are new jokes (some understated, some not so subtle) because we firmly believe that learning should be fun and medicine a pleasure to master. As with all our books, this book has undergone peer review to ensure that the material is relevant and contemporary. We welcome feedback and suggestions to aid learning. Please contact us via the publisher if you have any suggestions or ideas for the next edition.
We hope you will be inspired to master clinical skills by using this book. Our companion and larger textbook, *Clinical Examination: A Systematic Guide to Physical Diagnosis*, provides greater detail for more senior students and graduates. The journey here is as important as the end result, so please enjoy it. We wish you every success!

*Nicholas J Talley & Simon O'Connor*

*Newcastle and Canberra, September 2015*
We are very grateful for the thoughtful and professional reviews received that have helped us to further strengthen each edition. We are convinced that peer review is essential not just to judge original research findings but also to advance the quality of medical education, including the accuracy and excellence of textbooks. We extend our appreciation to the following reviewers for their comments and insights into the fourth edition:

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In this chapter, the symptoms and signs of lung disease are presented. The assessment begins with the history (concentrating in detail on the presenting symptoms). As usual, the examination begins with an assessment of the peripheral signs of lung disease and progresses to an examination of the chest, as set out below.

**The respiratory system assessment sequence**

1. Presenting symptoms (e.g. dyspnoea, cough, wheeze, fever)
2. Detailed questions about presenting symptoms (SOCRATES)
3. Questions about previous lung problems and respiratory risk factors (e.g. smoking, occupation, pets)
4. Examination for peripheral signs of respiratory disease
5. Examination of the chest
6. Provisional and differential diagnosis
The respiratory history

PRESENTING SYMPTOMS (see Box 5.1)

Cough and sputum
Cough is a common presenting respiratory symptom. Ask about the duration and whether:
- the cough is dry or productive (i.e. of sputum)
- it is associated with wheeze
- the patient is taking any medications.
Since the quality of the cough is important, ask the patient to describe the type of cough and to give a demonstration.

Differential diagnosis of cough
1. A cough of recent origin, particularly if associated with fever and other symptoms of respiratory tract infection, may be due to acute bronchitis or pneumonia.
2. A chronic cough associated with wheezing may be due to asthma; sometimes asthma can present without wheeze.
3. An irritating chronic dry cough can result from the reflux of acid into the oesophagus or the use of certain antihypertensive drugs (angiotensin-converting enzyme [ACE] inhibitors).
4. A change in the character of a chronic cough may indicate the development of a new and serious underlying problem (e.g. infection or lung cancer).
5. A large volume of purulent (yellow or green) sputum suggests the diagnosis of bronchiectasis or lobar pneumonia.
6. Foul-smelling, dark-coloured sputum may indicate the presence of a lung abscess with anaerobic organisms.
7. Pink frothy secretions from the trachea, which occur in pulmonary oedema, should not be confused with sputum.
8. Haemoptysis (coughing up of blood) can be a sinister sign of lung disease and must always be investigated, because it may be due to carcinoma of the lung, pneumonia, tuberculosis, pulmonary infarction or bronchiectasis.
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Box 5.1
The respiratory history: presenting symptoms

Major symptoms
Cough
Sputum
Haemoptysis
Dyspnoea (acute or chronic, progressive or paroxysmal)
Wheeze
Chest pain
Fever
Hoarseness

Dyspnoea
Ask about the timing of onset, severity and pattern of dyspnoea.

T&O’C examination hint box

• Patients with a history of smoking or occupational dust exposure often have a respiratory cause for dyspnoea.
• The presence of fever or a productive cough also points to a lung problem.
• If unrelated to position and associated with a wheeze and cough, then dyspnoea at night may be due to cold- or allergen-induced (e.g. house dust mite) bronchoconstriction.
• Exertional dyspnoea associated with a sensation of chest tightness may be a presentation of angina.

In three out of four cases the cause of dyspnoea can be diagnosed from the history.
Dyspnoea can be graded from I to IV (see Box 5.2). It may be more useful, however, to determine the amount of exertion that is actually needed to cause dyspnoea (i.e. the distance walked, or the number of steps climbed) or the patient’s ability to perform daily tasks such as dressing and washing.

T&O’C examination hint box

Dyspnoea that is worse when the patient lies flat or that wakes the patient from sleep is more likely to be due to cardiac failure than lung disease.
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Box 5.2
Grading the severity of dyspnoea

- Class I—dyspnoea on heavy exertion
- Class II—dyspnoea on moderate exertion
- Class III—dyspnoea on minimal exertion
- Class IV—dyspnoea at rest

Questions box 5.1
What to ask the patient complaining of breathlessness

- denotes a possible urgent or dangerous problem
1. How long have you been breathless?
2. Is it intermittent?
3. Is it getting worse?
4. Does it occur when you try to exercise?
5. How much exercise can you do before it occurs? Can you walk indefinitely on the flat/one flight of stairs?
- 6. Are you breathless at rest? On lying down? (Orthopnoea)
7. Are you wheezy? (Airway obstruction) Does the wheeze come and go?
8. Do you cough up sputum? If so, recently or for a long time? (Pneumonia vs bronchiectasis)
9. Have you had a high temperature?
- 10. Has the breathlessness come on suddenly? (Pulmonary embolism) Instantaneously? (Pneumothorax)
11. Have you worked with industrial gases or dusts? (Hypersensitivity pneumonitis, interstitial lung disease)
- 12. Is the breathlessness associated with a feeling of tightness in the chest? (Angina, aortic stenosis, HCM [hypertrophic cardiomyopathy])
13. Is the problem that you cannot get a satisfying breath? (Anxiety)

Wheeze
A number of conditions can cause a continuous whistling noise that is often louder during expiration (wheeze). These include asthma, chronic obstructive pulmonary disease (chronic obstructive airways disease), airway obstruction by a foreign body or tumour, and pulmonary oedema (severe cardiac failure).

Chest pain
Chest pain due to respiratory disease is characteristically pleuritic in nature (i.e. sharp and worse with deep inspiration and
coughing). Thoracic muscle soreness is common when patients have an acute respiratory illness and cough.

**Other presenting symptoms**

- Patients may occasionally present with episodes of **fever at night** (e.g. tuberculosis and pneumonia) or **hoarseness** (e.g. laryngitis, vocal cord tumour or recurrent laryngeal nerve palsy).
- Patients with **obstructive sleep apnoea** (where airflow stops despite persistent respiratory efforts during sleep) typically present with daytime sleepiness (somnolence), chronic fatigue, morning headaches and personality disturbances. Very loud snoring may be reported by anyone within earshot.
- Some patients respond to anxiety by increasing the rate and depth of their breathing. This is called **hyperventilation**. The resultant alkalosis may result in paraesthesia of the fingers and around the mouth, light-headedness, chest pain and a feeling of impending collapse.
- **Anxiety** (e.g. during a panic attack) can also make patients feel that they need to take deep breaths or that they are unable to take a satisfying breath.

**PAST HISTORY**

Always ask about any previous respiratory illness (including pneumonia, tuberculosis and exacerbations of chronic bronchitis) or abnormalities of the chest X-ray or computed tomography (CT) scan that have been previously reported to the patient.

**TREATMENT**

Take a drug history:

- What drugs is the patient using?
- How often are these drugs taken? Are they inhaled or swallowed?

Almost every class of drug can produce lung toxicity. Examples include pulmonary embolism from use of the oral contraceptive pill, interstitial lung disease from cytotoxic agents, bronchospasm from beta-blockers or aspirin, and cough from ACE inhibitors.
OCCUPATIONAL HISTORY

Ask in some detail about:
- possible exposure to *dusts* in mines and factories (e.g. asbestos, coal, silica, iron oxide, tin oxide, cotton, beryllium, titanium oxide, silver, nitrogen dioxide or anhydrides)
- work or household exposure to *animals*, including birds (e.g. Q fever or psittacosis)
- exposure to *mouldy hay*, humidifiers or air-conditioners, which may also result in lung disease (e.g. hypersensitivity pneumonitis)
- exposure to spray painting and wood dusts, which may provoke *occupational asthma* that typically resolves on weekends or on holidays.

SOCIAL HISTORY

A smoking history (see Ch 1) must be taken as a routine. Find out who is at home as a support for the patient, especially if the respiratory disease has caused debilitating symptoms.

FAMILY HISTORY

There may be a family history of asthma, cystic fibrosis or emphysema. Alpha1-antitrypsin deficiency, for example, is an inherited disease associated with a family history of the development of emphysema in young middle-age.

Examination anatomy

The examination of the lungs makes more sense when the basic anatomy and function of the lungs and airways are kept in mind (see Figs 5.1 and 5.2). Always try to picture the structures that lie beneath the area of the chest being examined.

Examining the chest

Examination of the chest should include a search for signs of lung disease (see Box 5.3), chest wall abnormalities and, if relevant, examination of the female breasts (see Ch 10). The patient should be undressed to the waist and, if well enough, should sit over the edge of the bed.
Figure 5.1  Lobes of the lung—surface markings. (a) Anterior. (b) Posterior. (c) Right lateral. (d) Left lateral.

Box 5.3  The chest examination sequence

1. General appearance
2. Peripheral signs of lung disease
3. Assess the cough and look for the sputum mug
4. Examine the face
5. Feel the trachea
6. Test the forced expiratory time
7. Examine the chest:
   • inspection
   • palpation
   • percussion
   • auscultation
8. Examine the heart
9. Examine the abdomen
**GENERAL APPEARANCE**

In the ward, clinic or exam, note whether the patient looks well or unwell.

1. Does the patient appear unwell or in distress with the effort of breathing?
2. Look (and listen) for:
   - tachypnoea (a respiratory rate of more than 25 breaths per minute)
   - use of the accessory muscles of respiration during inspiration (sternocleidomastoids and scalene muscles; see Fig 5.3)
   - cyanosis
The chest

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THE PERIPHERAL SIGNS OF LUNG DISEASE

The hands

Pick up the patient’s right hand, then the left.

1. Look for clubbing (see Table 3.2). Respiratory causes of clubbing include carcinoma of the lung, chronic lung suppuration (e.g. pulmonary abscess, tuberculosis, bronchiectasis) and interstitial lung disease.

2. Look for cigarette staining of the fingers (actually caused by tar, because nicotine is colourless), more an indication of the way the patient holds the cigarette than of the number of cigarettes smoked.

3. Compression and infiltration by a peripheral lung tumour of a lower trunk of the brachial plexus result in wasting of the small muscles of the hands (see Fig 5.4).

Figure 5.3 Use of the accessory muscles of respiration at rest (most reliably the scalene and sternocleidomastoid muscles) is a sign of respiratory distress.

- wheeze
- a spontaneous cough
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The wrist and arm

Measure the pulse rate and blood pressure. Tachycardia and pulsus paradoxus are important signs of severe asthma.

Character of the cough

1. Ask the patient to cough several times.
   - Lack of the usual explosive beginning may indicate vocal cord paralysis (the ‘bovine’ cough).
   - A muffled, wheezy ineffective cough suggests chronic obstructive pulmonary disease.
   - A very loose, productive cough suggests excessive bronchial secretions due to chronic bronchitis, pneumonia or bronchiectasis.

Figure 5.4 Wasting of the small muscles of the hands from lung cancer. (Perkin et al. Atlas of Clinical Neurology 3e. Copyright © 2011 by Saunders, an imprint of Elsevier Inc.)
A dry, irritating cough may occur with chest infection, asthma or carcinoma of the bronchus and less commonly with left ventricular failure or interstitial lung disease.

2. Impress your examiners and search for the sputum mug (see Fig 5.5) noting:
   - volume of sputum
   - type of sputum (purulent, mucoid or muco-purulent)
   - presence or absence of blood.

3. Obstruction of the larynx, trachea or large airways may cause stridor, a rasping or croaking noise loudest on inspiration. This can be due to a foreign body, a tumour, an infection (e.g. epiglottitis) or inflammation.

**Hoarseness**

Listen to the voice for **hoarseness**. Causes can include laryngitis, vocal cord tumour, recurrent laryngeal nerve palsy (e.g. from an apical lung cancer) or gastro-oesophageal reflux.

**The face**

1. A constricted pupil and a partial ptosis (partial closure of one eyelid) comprise **Horner’s syndrome** (p. 232). This can be due to an apical lung tumour compressing the sympathetic nerves in the neck.

2. Look for central **cyanosis** by inspecting the tongue.
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The trachea

1. Standing in front of the patient, push the forefinger of your right hand very gently up and backwards from the suprasternal notch until the trachea is felt. This examination is uncomfortable for the patient so be gentle. If the trachea is displaced to one side, its edge rather than its middle will be felt and a larger space will be present on one side than the other (see Fig 5.6).
   - Slight displacement to the right is fairly common in healthy people.
   - Significant displacement of the trachea suggests, but is not specific for, disease of the upper lobes of the lung.

2. Feel for a tracheal tug—the finger resting on the trachea feels it move inferiorly with each inspiration. This is a sign of gross overexpansion of the chest because of airflow obstruction.

3. Perform the forced expiratory time test. Ask the patient to take in a maximum inspiration, then exhale forcefully and completely through the open mouth. You can auscultate over the upper body of the sternum to time exhalation if on a noisy ward.
   - Normal is 3 seconds or less.
   - A forced expiratory time of 9 seconds or more is strongly suggestive of chronic obstructive pulmonary disease in a smoker.

![Feeling for the position of the trachea.](image-url)
THE CHEST

The chest should be examined anteriorly and posteriorly by **inspection, palpation, percussion** and **auscultation**. Compare the right and left sides during each part of the examination.

**Inspection**

1. Look at the shape and symmetry of the chest.
   - When the anteroposterior (AP) diameter is increased compared with the lateral diameter, the chest is described as **barrel-shaped** (see Fig 5.7a). This is an indication of **hyperinflation** of the lungs.
   - **Kyphosis** refers to an exaggerated forward curvature of the spine (see Fig 5.7b).
   - **Scoliosis** is lateral bowing (see Fig 5.7b). Severe thoracic kyphoscoliosis may reduce the lung capacity and increase the work of breathing.
   - Other quite common varieties in chest shape include **pectus excavatum** and **pectus carinatum** (pigeon chest) (see Fig 5.7c and d).

2. Inspect the chest wall for lesions.
   - Look for **scars** from previous thoracic operations, or from chest drains inserted for a previous pneumothorax (often under just below the clavicle) or pleural effusion (usually posterior and basal).
   - **Erythema** and **thickening** of the skin may result from radiotherapy for carcinoma of the lung or lymphoma. Occasionally, radiotherapy can cause burns and skin damage (see Fig 5.8). There is a sharp demarcation between abnormal and normal skin, and small tattoo dots used to delineate the radiation field may be visible.
   - **Subcutaneous emphysema** is a crackling sensation felt on palpating the skin of the chest or neck. It is caused by air tracking from the lungs and is usually due to a pneumothorax.
   - **Prominent veins** may be seen in patients with superior vena caval obstruction.

3. Look at the movement of the chest wall.
   - Look for **asymmetry** of chest wall movement anteriorly and posteriorly.
   - Assessment of expansion of the **upper lobes** is best achieved by inspection from behind the patient, looking...
Figure 5.7  Chest shapes. (a) Barrel chest: note the increased anteroposterior diameter of the chest. (Epstein O, Perkin D et al. Clinical Examination. Elsevier; 2008, Figure 5.36.) (b) Very severe kyphosis and scoliosis spinal deformations at an adult age, causing major back pain and contributing to the onset of restrictive respiratory insufficiency. (Laffont I, Tiffreau JM, Yelnik V, Herisson A, Pelissier C. Aging and sequelae of poliomyelitis. Annals of Physical and Rehabilitation Medicine 2009; 53(1): 24–33.)
down at the clavicles during moderate respiration. The affected side will show delayed or decreased movement.

- For assessment of **lower lobe** expansion, the chest should be assessed from behind by palpation.
- **Reduced chest wall movement on one side** may be due to localised pulmonary fibrosis, consolidation, collapse, pleural effusion or pneumothorax.
- **Bilateral reduction** of chest wall movement indicates a diffuse abnormality, such as chronic obstructive pulmonary disease or diffuse interstitial lung disease.
Palpation

1. **Chest expansion.**
   - Place your hands firmly on the back of the chest wall with your fingers extending around the sides of the chest. Your thumbs should almost meet in the middle line and should be lifted slightly off the chest so that they are free to move with respiration (see Fig 5.9). As the patient takes a big breath in, your thumbs should move apart symmetrically at least 5 cm. Reduced expansion on one side indicates a lesion of the lobe on that side.
   - Note: Test for Hoover’s sign if you suspect COPD. Place your hands around the costal margins of the patient, who is lying in bed. Your thumbs should sit over the xiphisternum, off the skin. Ask the patient to take big breaths in and out. Normally, your thumbs will separate as the patient breathes in. Patients who have COPD have an overexpanded chest and rely on diaphragmatic

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**Figure 5.8** Patient who developed Grade 4 skin necrosis from stereotactic body radiation therapy. (Hoppe BS et al. Acute skin toxicity following stereotactic body radiation therapy for stage I non–small-cell lung cancer: Who’s at risk? *International Journal of Radiation Oncology Biology Physics* 2008; 72(5), Figure 1.)
movement to expand the lungs during inspiration. This causes the lower ribs and your thumbs to move inwards: Hoover’s sign (see Fig 5.10).

**T&O’C examination hint box**

The diagnosis of COPD is strongly suggested by a history of cigarette smoking (more than 10 packet years) and a positive Hoover’s sign.
2. **Vocal fremitus.**
   - Palpate the chest wall with the palm of your hand while the patient says ‘ninety-nine’ aloud.
   - The front and back of the chest are each palpated in two comparable positions with the palm of one hand on each side of the chest. In this way differences in vibration on the chest wall can be detected.
   
   This can be a difficult sign to interpret. The causes of change in vocal fremitus are the same as those for vocal resonance (see p. 125).

3. **The ribs.** Gently compress the chest wall anteroposteriorly and laterally. Localised pain suggests a rib fracture, which may be secondary to trauma or may be spontaneous as a result of tumour deposition or primary bone disease.

**Percussion**

Use the following percussion technique. With your left hand on the chest wall and your fingers slightly separated and aligned with the ribs, press your middle finger firmly against the patient’s chest. Use the pad of your right middle finger to firmly strike the middle phalanx of the middle finger of your left hand. Remove the percussing finger quickly so that the note generated is not dampened. The percussing finger must be held partly flexed and a loose swinging movement should come from the wrist and not from the forearm (see Fig 5.11).

1. Percuss the following areas.
   - Percuss on both sides of the anterior, posterior (see Fig 5.12) and axillary regions and in the supraclavicular fossa over the apex of the lung.
• Percuss the clavicle directly with the percussing finger.
• For percussion posteriorly, the scapulae can usefully be moved out of the way by asking the patient to move the elbows forwards across the front of the chest.

**T&O’C examination hint box**

Good percussion technique can only be learnt by practice, and distinguishes the excellent student from the rest. The percussing finger should be flexed at the proximal interphalangeal joint and straight at the distal interphalangeal joint. It should be lifted immediately after it strikes to prevent its deadening the percussion note. Adjust the force of percussion to suit the patient. Do not make a frail elderly woman’s percussion note vibrate throughout the hospital.
2. The feel of the percussion note is as important as its sound. The note is affected by the thickness of the chest wall, as well as by underlying structures.
   - Percussion over a solid structure such as the liver or a consolidated area of lung produces a dull note.
   - Percussion over a fluid-filled area, such as a pleural effusion, produces an extremely dull (stony dull) note.
   - Percussion over the normal lung produces a resonant note.
   - Percussion over hollow structures such as the bowel or a pneumothorax produces a hyper-resonant note.

3. Liver dullness. The upper level of liver dullness is determined by percussing down the anterior chest in the midclavicular line. Normally, this level is over the fifth rib in the right midclavicular line. If the chest is resonant below this level it is a sign of hyperinflation of the lungs, usually due to emphysema or asthma.

Auscultation
Wash your hands and stethoscope (see Fig. 3.1).
1. Using the diaphragm of the stethoscope, listen to the breath sounds in the areas shown in Figure 5.13. It is important to compare one side with the other.
   - Remember to listen high up into the axillae and, using the bell of the stethoscope applied above the clavicles, to listen to the lung apices.
   - Listen for the quality and intensity of the breath sounds and for the presence of additional (adventitious) sounds.

2. Establish the quality of the breath sounds. Normal breath sounds are heard with the stethoscope over all parts of the chest. They were once thought to arise in the alveoli (vesicles) of the lungs and are therefore called vesicular sounds.
   - Normal (vesicular) breath sounds are louder and longer on inspiration than on expiration and there is no gap between the inspiratory and expiratory sounds.
   - Bronchial breath sounds are heard when turbulence in the large airways is heard unfiltered by the alveoli. Bronchial breath sounds have a hollow, blowing quality. They are audible throughout expiration and there is often a gap between inspiration and expiration. The
CHAPTER 5  The chest

Figure 5.13  Where to auscultate, 1–10.

expiratory sound has a higher intensity and pitch than the inspiratory sound. They are heard over areas of consolidation since solid lung conducts the sound of turbulence in main airways to peripheral areas without filtering.

3. **Assess the intensity of the breath sounds.** It is better to describe breath sounds as being of normal or reduced intensity than to speak about air entry. Causes of **reduced** breath sounds include:
   - chronic obstructive pulmonary disease
   - pleural effusion (absent breath sounds)
   - pneumothorax (absent breath sounds)
   - a large neoplasm (causing obstruction to a bronchus)
   - pulmonary collapse.

4. **Listen for any added (adventitious) sounds.** There are two types of added sounds: continuous (wheezes) and interrupted (crackles).
   - **Wheezes** are usually the result of acute or chronic obstructive pulmonary disease due to asthma (often high-pitched) or chronic obstructive pulmonary disease (often low-pitched).
Interrupted non-musical sounds are best called **crackles**. Note if they are early inspiratory or late or pan-inspiratory:

- **Early inspiratory crackles of medium coarseness** are suggestive of chronic obstructive pulmonary disease. They differ from those heard in left ventricular failure, which occur later in the respiratory cycle.
- **Late or pan-inspiratory crackles** suggest disease confined to the alveoli. They may be fine, medium or coarse in quality:
  - **Fine crackles** have been likened to the sound of hair rubbed between the fingers or to the sound Velcro makes when being unstrapped. They are typically caused by interstitial lung disease.
  - **Medium crackles** are often due to left ventricular failure. They can also be present in patients with chronic obstructive pulmonary disease.
  - **Coarse crackles** are characteristic of pools of retained secretions (e.g. bronchiectasis) and have an unpleasant gurgling quality.

5. **Listen for a pleural friction rub.** This occurs when thickened, roughened pleural surfaces rub together as the lungs expand and contract; a continuous or intermittent grating sound may be audible. A pleural rub indicates **pleurisy**, which may be secondary to pulmonary infarction, pneumonia or inflammation of the pleura associated with systemic inflammatory diseases or viral infection.

If a localised abnormality is found on auscultation, try to determine the lobe involved (see Fig 5.1). Further localisation of a mass or opacity on chest x-ray to a bronchopulmonary segment is important and sometimes localised abnormality can be appreciated clinically (see Fig 5.2). Medical students do not need to remember the lung segments for their clinical examination.

**T&O’C examination hint box**

Medium coarse early inspiratory crackles suggest COPD (usually severe) but should not be used on their own to distinguish left heart failure from COPD.
VOCAL RESONANCE

Auscultation over the chest while the patient speaks gives further information about the lungs’ ability to transmit sounds. Ask the patient to say ‘ninety-nine’ while you listen over each part of the chest.

- Over normal lung the low-pitched components of speech are heard with a booming quality and high-pitched components are attenuated.
- Over consolidated lung the numbers will become clearly audible, whereas over normal lung the sound is muffled.

If vocal resonance is present, bronchial breathing is likely to be heard.

It is important to piece the puzzle together as you examine: it is the combination of disease signs that will guide your provisional diagnosis and next steps (see Table 5.1).

THE HEART

1. Lay the patient at 45° and examine the jugular venous pressure (JVP) for evidence of right heart failure.

2. Palpate and auscultate the praecordium with close attention to the pulmonary component of the second heart sound (P2). This may be palpable or audible with increased intensity at the second intercostal space on the left. It should not be louder than the aortic component, best heard at the right second intercostal space. If P2 is palpable and louder, pulmonary hypertension should be suspected.

3. Feel to the left of the sternum with the heel of your hand for a parasternal impulse (see Fig 5.14)—a sign of right ventricular enlargement.

THE ABDOMEN

Feel for the edge of the liver. It may be palpable below the right costal margin when the lungs are overexpanded or pulsatile if there is tricuspid regurgitation secondary to chronic lung disease.
# TABLE 5.1 Comparison of the chest signs in common respiratory diseases

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Mediastinal displacement</th>
<th>Chest wall movement</th>
<th>Percussion note</th>
<th>Breath sounds</th>
<th>Added sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidation</td>
<td>None</td>
<td>Reduced over</td>
<td>Dull</td>
<td>Bronchial</td>
<td>Crackles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>affected area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collapse</td>
<td>Ipsilateral shift</td>
<td>Decreased over</td>
<td>Dull</td>
<td>Absent or</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>affected area</td>
<td></td>
<td>reduced</td>
<td></td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>Heart displaced to</td>
<td>Reduced over</td>
<td>Stony dull</td>
<td>Absent over</td>
<td>Absent; pleural</td>
</tr>
<tr>
<td></td>
<td>opposite side (trachea</td>
<td>affected area</td>
<td></td>
<td>fluid; may</td>
<td>rub may be</td>
</tr>
<tr>
<td></td>
<td>displaced only if</td>
<td></td>
<td></td>
<td>be bronchial</td>
<td>found above</td>
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<tr>
<td></td>
<td>massive)</td>
<td></td>
<td></td>
<td>at upper</td>
<td>effusion</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>Tracheal deviation to</td>
<td>Decreased over</td>
<td>Resonant</td>
<td>Absent or</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>opposite side if</td>
<td>affected area</td>
<td></td>
<td>greatly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>under tension</td>
<td></td>
<td></td>
<td>reduced</td>
<td></td>
</tr>
<tr>
<td>Bronchial asthma</td>
<td>None</td>
<td>Decreased</td>
<td>Normal or</td>
<td>Normal or</td>
<td>Wheeze</td>
</tr>
<tr>
<td></td>
<td></td>
<td>symmetrically</td>
<td>decreased if</td>
<td>reduced</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>severe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interstitial</td>
<td>None</td>
<td>Decreased</td>
<td>Normal</td>
<td>Normal</td>
<td>Fine, late</td>
</tr>
<tr>
<td>pulmonary</td>
<td></td>
<td>symmetrically</td>
<td>unaffected</td>
<td></td>
<td>or pan-inspira-</td>
</tr>
<tr>
<td>fibrosis</td>
<td></td>
<td>(minimal)</td>
<td>by cough or</td>
<td></td>
<td>tory crackles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>posture</td>
<td></td>
<td>over affected</td>
</tr>
<tr>
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<td></td>
<td></td>
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<td></td>
<td>lobes</td>
</tr>
</tbody>
</table>
Includes emphysema and chronic bronchitis, and chronic asthma where airflow obstruction is not totally reversible.

**Important differential diagnoses**

**Respiratory**
- Chronic obstructive pulmonary disease (COPD)
- Asthma
- Interstitial lung disease
- Infection (e.g. pneumonia, bronchiectasis)
- Tracheal obstruction
- Pulmonary embolism
- Pneumothorax
- Pleural effusion

**Cardiac**
- Cardiac failure
- Angina
- Aortic stenosis
- Hypertrophic cardiomyopathy (HCM)
- Mitral stenosis
- Pericardial tamponade

**Other**
- Obesity
- Loss of physical fitness
- Anaemia
- Anxiety
- Musculoskeletal disease
- Ketoacidosis

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1 Includes emphysema and chronic bronchitis, and chronic asthma where airflow obstruction is not totally reversible.
Clinical examination essentials

T&O’C examination hint box 5.1  How to examine the patient complaining of breathlessness

(Wash your hands)

! denotes a possible urgent or dangerous problem

1. Make a general inspection for:
   • dyspnoea at rest
   • use of accessory muscles
   • cyanosis
   • sighing respiration (anxiety)
   • rapid deep respiration (ketoacidosis)
   • lack of respiratory effort, drowsiness (CO₂ narcosis)
   • audible wheeze
   • overexpanded chest
   • obesity
   • anaemia

2. Examine the respiratory system, looking especially for:
   • cough (look at the sputum)
   • clubbing (suppurative lung disease or interstitial lung disease)
   • Hoover’s sign
   • fever
   • wheeze
   • bronchial breathing (consolidation)
   • absent breath sounds (pneumothorax, severe asthma)
   • stridor (tracheal obstruction)

3. Examine the cardiovascular system, looking in addition for:
   • hypotension
   • signs of cardiac failure (S3, displaced apex beat, basal crackles, elevated JVP, positive hepatojugular reflux test)
   • aortic stenosis
   • mitral stenosis
   • Kussmaul’s sign (pericardial tamponade—associated with severe dyspnoea, hypotension and tachycardia)

The chest OSCE: hints panel

1. This woman has a problem with cough. Take a history from her.
   (a) Ask her about the cough: how long and whether it is productive or not, is getting better or worse, is worse lying down and prevents sleep.
   (b) Ask about the sputum: volume, colour, presence of blood etc.
   (c) Ask about dyspnoea, wheeze and pleuritic chest pain.
   (d) Ask her about any history of known lung disease, including the details.
   (e) Ask her about any current medications.
   (f) Synthesise and present your findings.
2. This man has been breathless. Take an occupational history from him.
   (a) Ask him the following:
      (i) What is your job?
      (ii) What does this involve, in detail? How long have you been doing this work?
      (iii) What ventilation arrangements are provided at work?
      (iv) Are you or other workers or customers permitted to smoke at work?
      (v) Does your work involve exposure to dusts, solvents or animals? (If this is not already clear.)
      (vi) What previous work have you done? What did that involve?
      (vii) Have you any hobbies or pets?
   (b) Present your findings and outline the possible risk associated with any exposure.

3. This man has breathlessness and chest pain made worse by inspiration. Please examine him.
   (Wash your hands and for extra marks your stethoscope)
   (a) If necessary, ask the patient to undress to the waist. Look for wasting and pallor, nail clubbing and cigarette staining of the fingers, and pain on inspiration (pleuritic chest pain).
   (b) Record his respiratory rate and take his temperature.
   (c) Sit him over the side of the bed or ask him to sit upright.
   (d) Stand back and look for central cyanosis (tongue), bruising (trauma) and red raised skin lesions (vasculitis).
   (e) Feel the trachea position. Is it mid-line?
   (f) Examine the chest first from the front and then from the back: inspect, palpate, percuss and auscultate. Note any signs of a friction rub, pneumonia or a pleural effusion.
   (g) Lay the patient at 45° and assess his pulse, blood pressure, JVP and praecordium. (Pulmonary embolus)
   (h) Assess his lower legs for pitting oedema (bilateral) and signs of deep venous thrombosis (unilateral).
   (i) Synthesise and present your findings.

4. This man has haemoptysis and weight loss. Please examine him.
   (Wash your hands)
   (a) Look for obvious evidence of weight loss or cachexia.
   (b) Carefully inspect the nails of his hands for clubbing and look for wrist swelling. (Hypertrophic osteoarthropathy)
   (c) Look for wasting of the small muscles of the hands. (Pancoast tumour)
   (d) Feel for cervical and other lymph node groups.
   (e) Examine his chest systematically.
   (f) Palpate for tracheal deviation.
   (g) Particularly look for unilateral signs that might indicate a lung cancer (e.g. evidence of mediastinal shift, local area of dullness, signs of an effusion).
   (h) Synthesise and present your findings.
The chest history and examination
1. Dyspnoea of respiratory cause can sometimes be difficult to distinguish from cardiac dyspnoea, but a careful history can be diagnostic.
2. The smoking history and occupational history are particularly important in any patient with respiratory symptoms.
3. Production of sputum and particularly the presence of haemoptysis must be documented. Available sputum should be inspected.
4. Inspect for chest wall symmetry, palpate for expansion, percuss for dullness and auscultate for abnormal or reduced breath sounds. Examination of the upper lobes should not be forgotten.
5. Although a systematic and complete examination is essential, you may elect to examine the posterior chest (lower lobes) first, since in most cases ‘this is where the money is’ in respiratory disease.
6. Chronic obstructive pulmonary disease is suggested by a history of smoking, the presence of persistent wheeze, early inspiratory crackles and diminished breath sounds. Test for Hoover’s sign and forced expiratory time.
7. An absence of clinical signs does not exclude a respiratory disease; the clinical signs can be less sensitive than investigations such as a chest X-ray (e.g. for detection of a mass lesion) or spirometry (e.g. airflow limitation).