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Physical Signs in the Chest

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Abstract

Part 1 of a Series of Two Articles

This article is a personal one, based on my own practice and techniques. The evidence of the x-ray has taught consultants modesty in the evaluation of physical signs in the chest. In the good old days when the Chief said that there were dullness and diminished breath sounds in some area of the chest, the referee had spoken and there was no appeal. Nowadays he is liable to look rather silly if the x-ray is normal or the abnormality is found on the other side he is likely, therefore, to be less dogmatic. We have also learnt, in the last few years, about "observer error". We know how differently even skilled observers may interpret the same phenomena and how even a skilled observer may fail to notice something which may be spotted immediately by one of his colleagues, or by himself on another occasion.

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PHYSICAL SIGNS IN THE CHEST

Part 1 of a Series of Two Articles

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LIMITATIONS

This article is a personal one, based on my own practice and techniques. The evidence of the x-ray has taught consultants modesty in the evaluation of physical signs in the chest. In the good old days when the Chief said that there were dullness and diminished breath sounds in some area of the chest, the referee had spoken and there was no appeal. Nowadays he is liable to look rather silly if the x-ray is normal or the abnormality is found on the other side. He is likely, therefore, to be less dogmatic. We have also learnt, in the last few years, about "observer error". We know how differently even skilled observers may interpret the same phenomena and how even a skilled observer may fail to notice something which may be spotted immediately by one of his colleagues, or by himself on another occasion.

We must therefore approach the problem of physical signs in the chest with proper modesty, realising our limitations but attempting to limit these limitations as much as possible. We now know how extensive radiological shadows in the chest can be, in spite of the failure to elicit any abnormal physical signs, even *after* seeing the x-ray. The patient can have advanced pulmonary tuberculosis with no abnormal physical signs whatsoever. There can be a large peripheral tumour, or a large

cavity, without anything abnormal detectable on examination of the chest. It is in fact very rare, in the presence of a cavity on the x-ray, to find the classical physical signs of a cavity.

These discrepancies probably arise because there is normally aerated lung peripheral to the lesion. This protects it from discovery by methods of observation which inevitably have to be applied to the chest wall. Hence the value of x-rays.

Nevertheless the x-ray also has its limitations. In bronchitis or asthma the x-ray is very frequently normal, and is not uncommonly normal in a patient with bronchiectasis unless a bronchogram is done. In these instances the physical signs will be very helpful in diagnosis and in following the progress of the case. From an x-ray one gets relatively little help regarding what is going on inside the bronchus unless the bronchus is completely occluded.

Clinical medicine consists in weighing probabilities. No one finding from clinical or laboratory examination is absolute. Even a sputum reported as positive for tubercle bacilli may be due to an error in the laboratory; it could be someone else's sputum or occur because some other lesion in the chest happens to have eroded an old tuberculous focus. Therefore all clinical and laboratory findings must be measured against one an-

other to produce a total picture on which the probable diagnosis is based. Clinical signs are no exception to this rule. The clinician will first have taken a history and this will normally cause him to be seeking to exclude or confirm certain physical signs. Again the physical signs themselves must be weighed against one another. I would not put too much emphasis on an apparent deviation of the trachea to one side if this were not supported by other physical signs in the chest appropriate to any likely cause of deviation. When in doubt about any physical sign consider it in the light of all other information you have about the patient.

PRELIMINARIES TO EXAMINING THE CHEST

Although this article is primarily about the examination of the chest, one assumes that, before the chest is examined, certain observations will have been made. It will have been observed whether the patient is breathless or cyanosed, either when lying quietly on the bed or after taking off his clothes. The effort required to undress will often reveal a dyspnoea which was not obvious at rest. If the history suggests an acute illness, and if there is a history of chest pain, the physician will observe whether the alae nasi are moving with respiration, as is often the case in pneumonia. Whether there is any degree of wheeze will also have been noted. If the patient has a more chronic history, consistent with chronic bronchitis or emphysema, it will sometimes be noted that he breathes with "pursed lips" on expiration. It is thought that the pursed lips raise the pressure in the proximal bronchial tree on expiration and so help to keep open the small peripheral bronchioles which might otherwise be closed by air-trapping. It will also have been noted whether there is any finger clubbing, and the mouth, teeth and throat will have been examined.

ANTERIOR CHEST INSPECTION

Inspection of the chest may give useful information. Particularly when comparing the two sides of the chest it is desirable that the light should fall evenly on each side, so as to avoid misinterpretation. In most wards the bed is placed to one side of a window and it may be necessary to move the bed in order to obtain even illumination. It is often easiest

to appreciate the differences by looking at the patient from the end of the bed. However, these are nuances of technique which are more commonly performed in a class on Physical Signs than actually in clinical practice! On the whole, if the differences between the two sides are not reasonably obvious to the clinician standing beside the patient, they are not very important or are better elucidated by other methods.

SHAPE OF THE CHEST

There are three relatively common chest deformities:

1. *Harrison's sulcus*: This is a horizontal fixed in-drawing of ribs anteriorly, occurring on each side in the region of the 5th and 6th rib, forming a sort of transverse valley in the chest wall, sometimes giving an appearance of prominence to the costal margin. It is probably caused by repeated or continuous respiratory infections in childhood. The chest wall is sucked inwards on inspiration owing to obstruction of the bronchial tree by mucus or spasm. It was commoner at a time when many children were malnourished and treatment of respiratory infections was less effective, so that it is now more often seen in people who were children in the bad old days.

2. *"Pigeon" chest*: This is a narrow chest with prominent sternum and decreased transverse diameter, reminiscent of the bird's chest. It resembles not so much the feathered pigeon, with the rather broad appearance of the chest, but the pigeon awaiting carving! This also is more commonly seen in older people who are likely to have suffered malnutrition, particularly rickets, in childhood.

3. *Pectus excavatum*: This is a condition in which the sternum appears to be sunk into the chest, giving a vertical central sulcus. A little sinking of the lower part of the sternum is not uncommon but all degrees of the deformity can occur. It is congenital in origin.

Harrison's sulcus and pigeon chest are of no great clinical significance, except as indicators of rather impoverished childhood and perhaps less resistance to respiratory disease. The mildest degrees of *pectus excavatum* are unimportant but severe degrees may interfere with respiration and may even result in *cor pulmonale* later in life. The distortion of the heart may give rise to various murmurs and x-ray of the chest may be difficult to interpret unless the chest has first been inspected.

The symmetry of the two sides of the chest is important to observe. Undue flattening or indrawing beneath one of the clavicles may indicate long-standing fibrosis on that side.

In chronic bronchitis, emphysema and asthma the chest is often "barrel-shaped". In these conditions the lungs are distended owing to the bronchial obstruction on expiration. This results in a more horizontal position of the ribs and a wider subcostal angle. There may be kyphosis of varying degree.

CHEST WALL

Various scars may be seen on the chest wall. The scar of a thoracotomy is important if the patient has failed to give a history of the previous operation, although this is unlikely. It is rather more common for a patient to forget about the drainage of an empyema in youth. The tell-tale scar, 4 to 6 cms. long with a more circular scar where the tube was inserted, often gives the first indication that he has had an empyema in childhood. This knowledge frequently helps in the interpretation of the x-ray. The fact of a mastectomy will usually have been elicited from the history. Again this is important in interpreting the x-ray; in the absence of this knowledge the film may be regarded as having an abnormal density on the side where the breast is present or an abnormal translucency on the side of the mastectomy. Occasionally a lipoma of the chest wall is large enough to produce some change in density on the x-ray and its presence should certainly be noted. Under-development, or absence, of the pectoral muscles is a rare congenital deformity which should be noted as it may, again, give rise to difficulty in interpreting the x-ray. The shrewd student will also notice prick marks in the chest indicating that attempts have been made to aspirate an effusion; but he must remember that these may have been unsuccessful!

RESPIRATION

The rate of respiration will be noted. The patient lying quietly at rest in bed should be breathing at the rate of 10-12 per minute. He will obviously breathe more rapidly if he has just been taking off his clothes. It will be noted whether he is using his accessory muscles of respiration. The patient with dry pleurisy may be breathing rapidly and shallowly. If asked to take a deep breath there will often be an abrupt cessation of inspiration as the

pain catches him. At this stage in acute pleurisy the patient may be unable to breathe deeply enough for the observer to hear a rub, so that this catch in inspiration is a very useful confirmation of the presence of dry pleurisy.

In advanced emphysema, when the diaphragm has become grossly flattened, there may be a paradoxical indrawing of the lower costal margin on inspiration. Contraction of the diaphragmatic muscle is no longer able to flatten the dome of the diaphragm, which is already flattened even in expiration, and results merely in the pulling of the ribs inwards. In such patients, and in asthmatics, the respiratory movement is often more in the upper than the lower part of the chest, in contradistinction to the normal.

It is important to observe differences between the two sides in the respiratory excursion. These differences are more easily observed on the front of the chest. The subclavicular area and the region of the lower axilla should be looked at separately. Any asymmetry should later be confirmed by palpation.

Finally, the apex beat should be sought by inspection. This is usually not feasible in women. In men it is sometimes possible to see the apex beat by inspection when it is not possible to palpate it. It is, of course, not always possible to see the pulsation owing to fat or to underlying emphysema. It is often easiest to see the apex beat if the light is falling obliquely on the patient's chest, preferably from the patient's left, and if the clinician bends down a little to look obliquely across the patient towards the light.

PALPATION

TRACHEA

Deviation of the trachea to one side is an important physical sign, but it is not very easy to elicit with certainty. If it is thought to be deviated it is wiser not to commit oneself until the examination of the chest has been completed. If the deviation fits in with the other physical signs then it is reasonable to accept it.

There are two main methods of determining deviation and it is wise to employ both.

(1) Insertion of the finger directly backwards in the suprasternal notch. The finger is inserted exactly in the centre of the notch and it is determined whether it touches the centre of the anterior surface of the trachea. If the

trachea is deviated the finger will touch it to one or other side of the centre.

(2) Insertion of the finger between the lower part of the trachea and the sternomastoid on each side. If the fossa appears narrower on one side, then the trachea is deviated to that side.

APEX BEAT

If the apex beat has not been determined on inspection it is easiest to start by placing the flat of the hand on the chest wall in the region of the 5th and 6th intercostal spaces on the left side. The approximate site of the impulse can usually be felt and the precise site can be determined with the middle finger. The normal situation is approximately 9 cm. from the mid-line, or just inside the mid-clavicular line.

The appreciation of different types of apex beat, and the abnormal pulsations to the left of the sternum and in the epigastrium found in *cor pulmonale*, are not within the scope of the present article.

THE CHEST WALL AND LYMPH GLANDS

It is convenient, at this stage of the examination, to palpate for enlarged lymph glands. The neck is first palpated. The tonsillar glands are felt for on each side and then the anterior and posterior triangles and the retroclavicular area. It is wise to repeat this palpation later when the posterior chest is examined, as it is very much easier to palpate supraclavicular glands, and the important group lying behind the lower end of the sternomastoid, from behind, with the sternomastoid relaxed by turning the head to that side.

Both axillae are then palpated for glands. The left axilla is palpated by lifting the arm with the left hand and palpating upwards and towards the chest wall with the right. The right axilla is palpated with the clinician's left hand, the patient's arm being held with the right hand. The epitrochlear regions are then palpated.

Palpation of the chest wall is particularly important if the patient has complained of pain in the chest. This examination is too often omitted. The patient should be asked to indicate with one finger the precise site of the pain. The clinician should then palpate this site by pressing with his middle finger,

lightly at first in case there is acute tenderness. It may be possible to determine that the site of tenderness lies precisely over a rib, suggesting a fracture (perhaps due to coughing) or a secondary deposit. If the tenderness is over the intercostal muscles, it may indicate intercostal fibrositis, a condition of ill-defined aetiology. Nevertheless, tenderness is sometimes present over the site of pleurisy so that intercostal tenderness must be interpreted with caution and considered with the other physical signs.

It is well also, particularly if a neoplasm is suspected, to run the hand smoothly over the chest wall, as enlarged glands are sometimes palpable on the lateral chest wall, particularly if the wall or parietal pleura is invaded by the neoplasm.

In a woman the breasts should be palpated to exclude a neoplasm.

MOVEMENT

Differences in respiratory excursion between the two sides are most easily appreciated by palpation. The hands should first of all be placed symmetrically over the upper chest wall below the clavicle, with the fingers pointing upwards. It is usually relatively easy to determine whether one of the apices is moving less than the other.

The movement of the lower chest is best appreciated by firmly grasping the lower chest with both hands, the thumbs meeting in the centre over the sternum and the fingers grasping the patient's chest round the axillae. The patient is asked to take a big breath and the movement of the thumb from the midline on each side is noted. If one side of the chest is moving less well there will be less deviation of the thumb from the mid-line.

PERCUSSION

It is presumed that the student will have been taught how to percuss, using the left middle finger as a plectrum, and percussing on it vertically with the terminal phalanx of the right middle finger. When percussing the front of the chest the novice is likely to percuss too hard. Differences are much more readily appreciable if percussion is only just hard enough to elicit resonance. Relatively slight degrees of dullness are then readily appreciated, when a comparison is made between the normal and abnormal sides. If the patient is particularly obese, or when examining the back

where much greater thickness of muscle overlies the chest wall, percussion must be harder in order to elicit the normal resonance.

The clavicle should first be percussed lightly on each side. In this case the clavicle provides its own plectrum and the left middle finger need not be used. The enthusiast may percuss in both supraclavicular fossae, although this is often omitted and is probably not very helpful.

Percussion is then carried out in each successive interspace, comparing the interspaces on each side down the chest wall. It is particularly important to determine the upper level of liver dullness, which is most easily done in the midclavicular line on the right side. With quiet breathing and the patient lying in bed, liver dullness normally lies at the level of the 6th rib. Deviation of the liver dullness downwards is indicative of lung inflation, due to *emphysema* or the *diffuse bronchial obstruction* of asthma or bronchitis.

The percussion note in the upper and lower axillae on each side is then determined.

If *emphysema* is suspected it is worth while percussing the cardiac dullness, which normally extends downwards from the 3rd rib to the left of the sternum and from the left of the sternum out towards the apex beat. This dullness may also be diminished by lung inflation due to *emphysema* or *diffuse bronchial obstruction*.

VOCAL FREMITUS

In my opinion, vocal fremitus is only of real value when deciding the presence or absence of pleural effusion. In practice I only use this physical sign if percussion has shown dullness at one or other base. Vocal fremitus is frequently absent over an effusion whereas it is present or exaggerated over consolidation and may be either exaggerated or somewhat diminished over an area of collapse.

Vocal fremitus is usually of little help in women owing to the relatively slight resonance from their high-pitched voices. In my view it is more easily appreciated and localised by using the medial edge of the hand, with the hand held at right angles to the chest wall. Fremitus is tested for below both clavicles, in the lower anterior chest and in the upper and lower axillae.

AUSCULTATION

In my experience the best simple stethoscope for listening to respiratory sounds is the bell,

fitted with a rubber cap. A metal bell is often too cold for patients in winter, the bakelite often breaks against the side of the bed and its friction on the skin of the chest wall may simulate a pleural rub. The rubber cap prevents the stethoscope slipping on the skin, and thus simulating a rub; it is also more comfortable for the patient.

Auscultation is a very important part of the examination of the chest. Most physical signs which can be elicited by the methods already outlined give little information which cannot be as well or better obtained from an x-ray film. A number of the physical signs which may be elicited by auscultation give information about the underlying pathological condition which is not obtainable by an x-ray.

BREATH SOUNDS

The student should train himself to analyse the qualities of the breath sounds, in particular the *duration* of inspiration and expiration relative to one another, the *pitch* of inspiration and expiration relative to one another, and the general harshness, blowing quality or normal softness of the respiration.

In *normal vesicular breathing* the quality is soft, the *duration* of inspiration is longer than that of expiration, and the inspiratory sound is higher in *pitch* than that of expiration. The sound of inspiration tends to fade into that of expiration without any obvious gap, in contradistinction to bronchial breathing; this distinction between the two types of breathing has always seemed to me difficult to appreciate and unhelpful and I think it is of little use in practice.

In *bronchial breathing* the general quality of the sounds is harsh or blowing, the *duration* of expiration is as long or longer than that of the inspiratory sound and the *pitch* of the expiratory sound is as high or higher than that of inspiration.

Although always harsh or blowing, the general quality of bronchial breathing varies a good deal. Although the relative pitch of inspiration and expiration remains as stated, the pitch of the whole respiratory sound may be relatively high or relatively low. Over consolidation or a thin layer of fluid the pitch tends to be high. If the sound is resonating in a large intrapulmonary cavity, or occasionally if the bronchial sound is heard resonating through a pneumothorax, the quality is similar to that when one blows over the top of a bottle. Hippocrates

did not have bottles and so, in the days when classical studies were the background of every gentleman's culture, it was thought more respectable to refer to this type of breathing as *amphoric* after the Greek name for a jar. The significance of bronchial breathing is discussed below.

The student often has great difficulty in appreciating bronchial breathing. It is helpful for him to memorise a form of words describing bronchial breathing and to listen to the breathing with this in mind. Bronchial breathing is always to be heard over the trachea and it is useful for him to listen to these sounds and compare them with the definition given above. He should then ask himself the same questions about unusual sounds he hears in the patient's chest. Bronchial breathing may sometimes be heard in normal persons just to the right and left of the sternum in the region of the 2nd and 3rd interspaces and in these areas should not be regarded as definitely abnormal.

Whenever one is in doubt about the presence of bronchial breathing it is always wise to test for *whispering pectoriloquy* (see below) which is always present if there is bronchial breathing.

Bronchovesicular breathing is a sort of half way house between vesicular and bronchial breathing, when the quality of the whole breathing is more high-pitched and harsh, but where the breathing does not conform strictly to the definition of bronchial breathing. As with all compromises it is an indication of uncertainty and one should only regard it as a warning sign that there may be something abnormal about the area of the chest below the stethoscope. If possible the term is best avoided; one can usually make up one's mind whether the breathing one hears is bronchial or vesicular.

ADDED SOUNDS IN THE CHEST

There are three main types of added sounds in the chest, *crepitations*, *rhonchi* and the sound of a *pleural rub*. The terms "*râles*" is, very properly, not used in Edinburgh because it has been used in various senses elsewhere. The detection of rhonchi, crepitations and rubs is very important because they may give one information about the patient which is not obtainable from the x-ray. Fortunately, it is usually relatively easy to identify rhonchi and

crepitations, but the detection of a rub sometimes gives rise to difficulty.

Rhonchi are squeaky wheezy noises made by air passing through the moist tubes of abnormally narrow bronchi. As the bronchi are narrower on expiration than on inspiration, expiratory rhonchi are more common than inspiratory, although both may occur. Quite often there are slight differences between the rhonchi heard in different parts of the lung, indicating that the noises are derived from a large number of small bronchi, as in the case of bronchitis. Occasionally the rhonchi are heard only in one particular area of the lung, suggesting a locally narrowed bronchus, as may sometimes occur with a carcinoma. Sometimes the rhonchi heard throughout the lung are of exactly the same quality and one feels as if one is hearing "one" rhonchus. This is probably due to the diffusion of the sounds from narrowing, as by some sticky mucus, in the lumen of one rather large proximal bronchus.

Crepitations are discontinuous sounds, made either by the opening up of alveoli filled with exudate or by air bubbling through mucus in bronchi of various sizes. *Fine crepitations* are probably derived from the alveoli and sound like the noise one hears if one rubs a lock of hair between one's fingers. *Medium crepitations* are more bubbling in quality and probably derived from smaller bronchi. *Coarse crepitations* are also bubbling and are derived either from large bronchi or from bronchiectatic dilatations of more peripheral bronchi.

Pleural rubs usually give the student a good deal more trouble. If the patient has pleuritic pain he may be unable to breathe deeply enough for a rub to be detected. However, the tell-tale sharp catch in his breathing, when asked to take a deep breath, is indication enough of the pleuritic type of pain whether or not a rub is heard. When listening for a rub the patient should be asked to place one finger exactly on the site of maximum pain. It is in this area that the rub should be carefully sought.

Rubs are of very variable quality. Early in pleurisy, when the patient still has acute pain, the rub is often heard at the extreme end of inspiration and is very similar to fine crepitations. Apart from the guide given by the patient's pain, the best way to differentiate a rub from crepitations is to ask the patient to cough. Crepitations normally increase or decrease, whereas a rub will remain unchanged. A second type of rub is more like the creaking

of leather. This type is often heard both in inspiration and expiration. The rub may be even coarser, sounding like two bits of sand-paper rubbed together. The latter two types of rub are usually quite readily detected, provided that the observer, because of his history-taking, is actively listening for them. If he is not, it is surprising what gross rubs can be missed.

VOCAL RESONANCE

Vocal resonance is the noise heard through the stethoscope when the patient is asked to say "ninety nine" or (a significant scientific advance made by the most up to date physicians!) "one—one—one". Although vocal resonance is increased, that is to say the voice comes through more loudly, in conditions such as consolidation, in practice this is not very helpful. The only helpful change in vocal resonance is the presence of *aegophony*, when the normal deep resonant note of the male is heard, through the stethoscope, as a bleating sound. As Hippocrates was well acquainted with goats, the term "*aegophony*" which means "the voice of the goat" was considered appropriate. Because of their naturally high-pitched voices *aegophony* is not a valuable physical sign in women. In practice, when *aegophony* is present whispering pectoriloquy is always present. Whispering pectoriloquy is as readily detected in women as in men and is easily identified; for this reason *aegophony* is not a very valuable physical sign, but is classical and unfortunately the student has to know about it.

Whispering pectoriloquy is a valuable physical sign for confirming the presence of

bronchial breathing. If the patient is asked to whisper "ninety nine" or "one-one-one", normally this is heard through the stethoscope merely as a distant rustling sound. If whispering pectoriloquy is present the whisper appears to be heard immediately under the stethoscope and the actual words can almost be identified. This physical sign is a valuable one and is always present when there is bronchial breathing.

POSTERIOR CHEST

The methods of examination are similar to those described for the anterior chest, but one or two special points should be mentioned.

Palpation: The neck should be carefully palpated for *enlarged lymph glands* as described on p.13. It is easier to feel glands behind the lower portion of the sternomastoid, or in the supraclavicular fossa, by palpation from behind.

When assessing movement of the lower part of the chest posteriorly the *sides* of the thorax should be firmly clasped with the fingers. The thumbs will not normally meet in the mid-line, but the relative movements of both thumbs can be readily appreciated.

Percussion: Because of the thick muscle-layers percussion over the back must be heavier than over the front of the chest in order to elicit the normal resonance. The upper level of the liver dullness is less readily compared with the normal, because of the greater difficulty in feeling and enumerating the ribs. Again because of the thick muscle-layers dullness at the apices should only be asserted if the difference between the two sides is clear-cut.

Part II. in our next issue will deal with the Interpretation of Signs.