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Book Second

OF DISEASES OF THE HEART

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REFERENCE


MEDIATE AUSCULTATION

[From On Mediate Auscultation*]

INTRODUCTION

In 1816 I was consulted by a young woman presenting general symptoms of disease of the heart. Owing to her stoutness little information could be gathered by application of the hand and percussion. The patient’s age and sex did not permit me to resort to the kind of examination I have just described (i.e., direct application of the ear to the chest). I recalled a well-known acoustic phenomenon: namely, if you place your ear against one end of a wooden beam the scratch of a pin at the other extremity is most distinctly audible. It occurred to me that this physical property might serve a useful purpose in the case with which I was then dealing. Taking a sheaf of paper I rolled it into a very tight roll, one end of which I placed over the praecordial region, whilst I put my ear to the other. I was both surprised and gratified at being able to hear the beating of the heart with much greater clearness and distinctness than I had ever done before by direct application of my ear.

I at once saw that this means might become a useful method for studying, not only the beating of the heart, but likewise all movements capable of producing sound in the thoracic cavity, and that consequently it might serve for the investigation of respiration, the voice, râles and even possibly the movements of a liquid effused into the pleural cavity or pericardium.

With this conviction, I at once began and have continued to the present time, a series of observations at the Hospital Necker. As a result I have obtained many new and certain signs, most of which are striking, easy of recognition, and calculated perhaps to render the diagnosis of nearly all complaints of the lungs, pleurae and heart both more certain and more circumstantial, than the surgical diagnosis obtained by use of the sound or by introduction of the finger.

I shall divide my work into four parts. The first will deal with the signs that can be obtained from the voice when heard by means of the cylinder (i.e., stethoscope); the second with those furnished by the respiratory sounds; the third with those supplied by râles; and, by way of appendix, the results at which I have arrived in my investigations on the effusion of liquids into the various cavities of the thorax; the fourth will contain an analysis of the heart-beats in health and in sickness, and an account of the special signs characterizing diseases of the heart and aorta.

Before proceeding with my subject, I consider it my duty to record the various attempts that I have made to improve upon the exploring instrument I at present use; these attempts have proved almost entirely vain, and, if I mention them, it is in the hope that any other investigator seeking to perfect the instrument will strike out a fresh path.

The first instrument employed by me consisted of a cylinder or roll of paper, sixteen lines in diameter and one foot long, made of three quires of paper rolled very tightly round, and held in position with gummed paper and filed smooth at both ends. However tight the roll may be, there will always remain a tube three or four lines in diameter running up the centre, because the sheets of paper composing it can never be rolled completely on themselves. This fortuitous circumstance gave rise, as will be seen, to an important observation upon my part: I found that for listening to the voice the tube is an indispensable factor. An entirely solid body is the best instrument that can be used for listening to the heart; such an instrument would indeed suffice also for hearing respiratory sounds and râles; yet these last two phenomena yield greater intensity of sound if a perforated cylinder is used, hollowed out at one end into a kind of funnel 1½ in. in depth.

The densest bodies are not, as analogy would lead us to suppose, the best materials for constructing these instruments. Glass and metals, apart from their weight and the sensation of cold that they impart in winter, are not such good carriers of the heart-beats and the sounds produced by breathing and râles, as are bodies of lesser density. Having noticed this fact, which at first caused me some surprise, I attempted to use the least dense substances possible, and consequently I had a cylinder made of goldbeater's skin, which could be inflated with air by means of a tap, while the central tube space was held open by another tube made of card. This cylinder is the worst of all; it yields less intensity of sound and, as a further drawback, becomes deflated every few minutes, particularly when the air is cold; in addition, it is of all cylinders the one most liable to render audible a sound other than that which is being explored, owing to the crepitation of its own walls and to friction with the patient's clothing or the observer's hand.

Substances of medium density, such as paper, wood and cane, are those which have always appeared to me preferable to all others. This result may be in contradiction with an axiom of physics; none the less I consider it to be quite established.

I consequently employ at the present time a wooden cylinder with a tube three lines (a French line 0.0888 in. or 2.256 mm.) in diameter bored right down its axis; it is divisible into two parts by means of a screw and is thus more portable. One of the parts is hollowed out at its end into a wide funnel-shaped depression 1½ in. deep leading into the central tube. A cylinder made like this is the instrument most suitable for exploring breath sounds and râles. It is converted into a tube of uniform diameter with thick walls all the way, for exploring the voice and the heart beats, by introducing into the funnel or bell a kind of stopper made of the same wood, fitting it quite closely; this is made fast by means of a small brass tube running through it, entering a certain distance into the tubular space running through the length of the cylinder. This instrument is sufficient for all cases, although, as I have already said, a perfectly
solid body might perhaps be better for listening to the beating of the heart.

The dimensions indicated above are not altogether unimportant; if the diameter is larger it is not always possible to apply the stethoscope closely against all points of the chest; if the instrument is longer, it becomes difficult to hold it exactly in place; if it were shorter, the physician would often be obliged to adopt an uncomfortable position, which is to be avoided above all things if he desires to carry accurate observations.

I shall be careful, when discussing each variety of exploration, to mention the positions which experience has taught me to be most favourable for observation and least tiring for both physician and patient.

Suffice it to say for the moment that in all cases the stethoscope should be held like a pen, and that the hand must be placed quite close to the patient's chest in order to make sure that the instrument is properly applied.

The end of the instrument intended to rest on the patient's chest, that is to say the end provided with the stopper, should be very slightly concave; it is then less liable to wobble, and as this concavity is easily filled by the skin it in no case leaves an empty space even when placed on the flattest part of the chest.

When excessive emaciation has destroyed the pectoral muscles, so as to leave depressions between the ribs so deep that the whole of the surface of the end of the stethoscope cannot rest at the same time on the chest, they may be filled up with lint or with cotton wrapped in linen or a sheet of paper. The same precaution must be taken when it is the heart that is being examined in those patients whose sternum is bent inwards at its lower end, as often happens with cobblers and some other handicraftsmen.

I have made other modifications in the stethoscope and I have tried various instruments of different shape, but as they cannot be of general use, I shall not speak of them till occasion arises.

Some of the signs obtained by mediate auscultation are very easy to distinguish, and if they have been heard once there will be no difficulty in again recognizing them; such are the signs indicative of cavities in the lungs, considerable hypertrophy of the heart, fistulous communication between the pleural cavity and the bronchi, etc. But there are others that require more study and practice, and for the very reason that this method of examination permits of much greater precision in diagnosis than any other, pains must be taken to use it to the very best advantage.

Mediate auscultation must not, however, lead us to neglect Auenbrugger's method; to which it gives, on the contrary, an entirely new importance, extending its use to numerous maladies in which percussion alone would be of no help or might positively lead to error. Thus it is, by a comparison of the results of both methods, that positive and evident signs can be obtained in emphysema of the lung, pneumothorax, and liquid effusions in the pleural cavity. Nor must we neglect other methods of examination that are more limited in their scope, especially Hippocratic succession, mensuration of the thorax, and even auscultation with the ear directly on the chest or immediate auscultation. These methods which have lapsed into oblivion and are by themselves often as liable to mislead the practitioner as to enlighten him, become in the cases which will be set forth in the present work, useful means of confirming the diagnosis established by mediate auscultation and percussion and of imparting to it the highest degree of certainty and accuracy that can be obtained in a physical science.

For various reasons, it is only in hospitals that a familiarity and thorough skill in the practice of mediate auscultation can be acquired, because it is necessary, at least sometimes, to have the conclusions reached by means of the stethoscope verified by post-mortem examination, in order that we may acquire confidence in ourselves and in the instrument, and that we may have reliance upon our own powers of observation and be convinced by the eye of the accuracy of the signs perceived by the hearing. It is sufficient, however, to have observed a disease on two or three occasions to learn how to recognize it with certainty; most of the affections of the lungs and heart are so common, that after a week's experience of them in a hospital, all that will be left to be studied are a few rare cases, almost all of which will be encountered in the course of a year, if every patient is examined with care. It would be doubtless imposing too much upon a physician whose whole time is devoted to private practice to require him to attend a hospital for so long a period; but a hospital physician whose duty it is to carefully examine all his patients daily, can easily save his professional brethren this trouble
by informing them whenever he comes upon a rare or specially instructive case.

**TUBERCULOUS AFFECTION OF THE LUNG**

[Book II, Chapter vii, Section 1]

The cavities producing pectoriloquy are those vulgarly known as ulcers of the lung. They are not, as was supposed, and is still believed by the majority of medical practitioners, an outcome of inflammation and suppuration of the pulmonary tissue. The recent advances in pathological anatomy have proved beyond all manner of doubt that these cavities are due to the softening and subsequent evacuation of a peculiar kind of accidental formation which modern anatomists have specially designated by the name tubercle, formerly applied without distinction to any sort of unnatural protuberance or tumour.

The presence of tubercles in the lung is the cause, and constitutes the peculiar anatomical characteristic of pulmonary phthisis.

The cavities produced by tubercle differ essentially from an ulcer; inasmuch as this spreads by eating into the tissue in which it is formed, whereas the first are produced by the spontaneous destruction of accidental formations which have pushed aside and compressed the pulmonary tissue, but not destroyed it, and have no tendency to increase at its expense.

The manner in which these morbid formations develop has been described by M. Bayle with much greater completeness and precision than had ever been achieved before. However, certain observations made since the publication of his Researches having enabled me to rectify or extend some of his remarks, I esteem it requisite, for the understanding of many things I shall have to say, to set forth in an abridged form the characteristics and mode of development of tubercles, points upon which I might otherwise have referred to the excellent work quoted above.

The tubercles develop in the form of small semi-transparent granules, grey in colour, though occasionally they are entirely transparent and almost colourless. Their size varies from that of millet-seed to that of hemp-seed; when in this state they may be termed miliary tubercles. These granules increase in size and become yellowish and opaque, first in the centre and then progressively throughout their substance. Those nearest together unite in the course of growth and then form more or less voluminous masses, pale yellow in colour, opaque, and comparable, as regards density, with the most compact kinds of cheese; they are called crude tubercles.

It is usually at about this stage in the growth of the tubercles that the pulmonary tissue, healthy up till now, begins to harden and to become greyish and semi-transparent around the tubercles owing to the fresh growth of tuberculous matter in its early or semi-transparent stage which infiltrates it.

Sometimes indeed tuberculous masses of great size are formed as a consequence of this impregnation or infiltration without any previous development of miliary tubercles. The pulmonary tissue thus congested is dense, moist and quite impregnable to air; when it is cut the incisions reveal a smooth polished surface. As these indurations gradually pass into the state of crude tubercles we may observe the appearance in them of a multitude of minute opaque yellow specks which multiplying and growing larger end by invading the whole of the hardened part.

In whatsoever manner these crude tubercles may be formed, they finish at the end of a longer or shorter time of very variable duration by becoming softened and liquefied. This softening starts near the middle of each mass, which daily becomes softer and moister until the softening has reached the periphery and become complete.

In this phase the tuberculous matter may present itself under two different forms: sometimes it resembles thick pus, but it is odourless and yellower than the crude tubercles; sometimes it separates into two parts, one of which is very liquid and more or less transparent and colourless unless it is contaminated with blood; the other part is opaque and has the consistency of soft, friable cheese. In this latter state, specially met with in scrofulous patients, it often bears a complete resemblance to whey in which small fragments of caseous matter are floating.

When the tuberculous matter has completely softened it breaks its way into the nearest bronchial tube. The resulting aperture being narrower than the cavity with which it communicates, both remain of necessity fistulous even after the complete evacuation of the tuberculous matter.

It is exceedingly rare to find only a single cavity in a lung thus affected. Usually these cavities are surrounded with crude tubercles and miliary tubercles which soften successively, burst into the main
cavity and give rise to the anfractuities generally to be observed in it, and which in some cases spread step by step until they reach the surface of the lung.

Cords or columns of dense pulmonary tissue generally permeated with tuberculous matter often traverse these cavities and somewhat resemble the fleshy columns in the ventricles of the heart; they are thinner towards the middle than at their extremities.

As the cavity gradually empties, its walls become coated with a sort of false membrane, thin, smooth, of a white colour, almost opaque, of a somewhat soft almost friable consistency, and it comes away readily when scraped with a scalpel. This membrane is generally complete, lining the whole inner surface of the cavity. Its place is occasionally taken, however, by a pseudo-membranous exudation, thinner, more transparent, less friable, and more closely adherent to the walls of the cavity which it usually covers only in patches. If it does happen to line the entire cavity, it presents at places much greater thickness, and this fact seems to point to its being the product of an exudation starting simultaneously at several different points.

Frequently this second membrane is found beneath the first which is then not completely adherent and is torn at various places.

Finally, sometimes we cannot find any perceptible trace of either variety of false membrane, and the walls of the cavity are formed by pulmonary tissue, which is generally hardened, red, and infiltrated with tuberculous matter in various stages of development. Judging from these facts I am of opinion that the second kind of false membrane is merely the early stage in the development of the first, that when this is completely formed it tends to peel off, and is then expectorated in fragments and replaced by new membrane, and that this matter forms one constituent of the sputum of consumptives.

M. Bayle believes that this false membrane secretes the pus which the patients expectorate. This opinion is based on the analogy which exists between it and that which forms on the surface of blisters and other ulcers. However that may be, it appears to me clear that the greater part of the sputum expectorated by sufferers from phthisis is formed by the bronchial secretion increased because of the condition which exists in the lungs. Although I do not intend to deny absolutely that it might be formed in the cavities, I would remark that when they are lined by the soft membrane, described above, they are often completely empty, or if they contain puriform matter, this resembles much less the sputum of the patient than does that which is contained in the bronchial tubes.

Should the disease come to a standstill for a length of time there will soon be formed here and there below the false membrane, greyish white semi-transparent patches in texture like cartilage, but a little softer, and very closely adherent to the lung tissue. In the course of growth these patches coalesce, and completely line the ulcerous cavity and end by continuity of substance with the inner membrane of the bronchial tubes opening into the cavity.

When this cartilaginous membrane is completely formed it is usually white or pearl grey in colour; should it assume an apparently reddish or purple tinge, this will be due to the thinness and semi-transparency of the membrane through which the colour of the lung tissue itself is visible.

At times, however, even when the cartilaginous membrane is of considerable thickness, its inner surface is pink or red, and this colour cannot be removed by washing; it is probably due to the presence of a network of fine vessels, although no distinct vessels can be discerned doubtless because of their minuteness.

In a few rare cases tubercles are found completely softened, or very nearly so, in the midst of thoroughly crepitant pulmonary tissue; in such cases (I have encountered only two or three in the course of eighteen years) the walls of the cavity are quite smooth and seem to be formed only of the pulmonary tissue slightly compressed without any kind of accidental membrane.

INVESTIGATION OF RESPIRATION

[Part I, Chapter IV, Section 1]

Auscultation of respiration by means of the stethoscope furnishes us with signs easy to apprehend, and peculiarly fitted to reveal the existence and extent of most of the organic complaints affecting the thoracic viscera—more especially peripneumonia, pulmonary phthisis, oedema and emphysema of the lung, the various kinds of tumours or new growths which make their appearance in that organ, pleurisy, blood-spitting, pleural effusion, and pneumothorax, or the collection of air in the pleural cavities.

The description and physical signs of some of these complaints will be reserved for the third part of this work, because the most
The stethoscope hollowed out at its extremity in the shape of a funnel is the one which should be employed for listening to respiration. If this form of stethoscope is placed against the chest of a man in good health, there will be heard, during both inspiration and expiration, the slight but most distinct murmur, which indicates the entrance of air into the pulmonary tissue and its expulsion. This murmur may be compared to the sound produced by a pair of bellows, the valve of which is noiseless, or, better still, to that heard by the unaided ear when a man, in deep and peaceful sleep, periodically draws a long inspiration. It is almost equally audible at all points of the chest, but especially at those spots where the lungs are nearest to the cutaneous surface—that is to say, in the anterior, superior, lateral, and lower posterior regions. The hollow of the armpit and the space between the clavicle and upper edge of the trapezius muscle are the points where it is heard with greatest intensity.

We can hear it equally well over the larynx and over the bare or cervical portion of the trachea—and even in many men over the whole length of the windpipe down to the base of the sternum; but over the trachea, and also in some degree at the roots of the bronchi, the respiratory sound has a special character, clearly showing that the air is passing through a roomier channel than the air cells; further, it often appears as if the patient, during inspiration, were drawing in the air contained in the tube of the stethoscope, again expelling it during expiration.

If the state of respiration is to be correctly judged by the stethoscope, we must not only rely upon the first few moments of examination. The placing of the ear in such a manner as to apply the instrument causes a sensation of buzzing. The timidity, constraint, and uneasiness experienced by the patient, causing him automatically to reduce the extent of his respiration; sometimes, too, the awkward position of the observer himself; the heart-beats, if unusually loud, and first heard by the ear, are all causes which may preclude at the outset a correct appreciation, or may, indeed, altogether prevent the hearing of inspiration and expiration. It is only after a lapse of a few seconds that a right judgment can be formed.

It is hardly requisite to add that no kind of noise must be going on in the neighborhood of the patient.
younger the child the more marked are these characteristics, which usually persist in varying degree till a little beyond puberty.

With the adult the respiratory sound varies much in intensity. There are men in flourishing health in whom it is scarcely audible, unless they draw a very long breath; and even then, though it is heard quite well and is quite pure, that is to say, unmixed with râles or other foreign sounds, it only has half the volume of sound and fremitus that is heard in the majority of men. Such persons will be generally found to be those whose respiration is not habitually frequent, and often they are not ordinarily subject to dyspnoea and loss of breath from any cause whatever.

The respiration of others is loud enough naturally to be quite easily heard even with ordinary inspiration, but they are not either more or less liable to shortness of breath than those just mentioned. Finally, a very few persons retain till extreme old age a respiration similar to that of childhood, to which for this reason I shall sometimes apply the name puerile respiration in the course of the present work. Such persons are nearly always women or men of nervous temperament. Something of the excitability, and especially the irri
tability of children is often to be noticed in their character. Some have not, strictly speaking, any disease of the respiratory organs, but they easily become out of breath after exertion, at the same time they are thin, and readily take cold. Others are afflicted with chronic catarrh coupled with dyspnoea, and this combination constitutes, as we shall see later, one of the maladies known by the name of asthma.

Apart from these exceptional cases, an adult, however strenuous his acts of inspiration may be, cannot give to his respiration the sonority and peculiar character possessed by it in childhood. In a few pathological cases, however, the respiration reverts to its puerile character spontaneously, without the patient appearing to inspire more forcibly than usual. This is observable especially when the whole of one lung or a considerable portion of both lungs has become impermeable to air as a result of some disease, and more particularly an acute disease. Over the parts of the lung which have remained healthy, the respiratory sound is exactly like that heard in children. The same phenomenon is observable throughout the whole extent of the lung in patients suffering from fairly serious fevers or certain nervous affections.

When, for the first time, a comparison is made between the respira-
DISEASES OF THE HEART

[From On Mediate Auscultation, Chapter xviii, Section 11]

INDURATION OF THE MITRAL VALVES

The symptoms of ossification of the mitral valve are little different from those attending the same affection of the sigmoid. According to M. Corvisart the principal sign of the mitral lesion is "a peculiar rustling sensation (bruisement) perceived on the application of the hand to the region of the heart." This peculiar sensation is nothing else than the purring-thrill already described. It is assuredly very frequently observed in the case of ossification of the mitral or sigmoid valves when this exists in a high degree; but, as I formerly stated, it may exist when these valves are perfectly sound, and it is almost always absent when the induration is not so extensive as materially to obstruct the orifices. The bellows-sound is a much more constant sign: it accompanies the contraction of the left auricle when the mitral valve is affected, and that of the ventricle, when the induration is in the sigmoid. But even this is wanting when the alteration is not extensive, and as it is, moreover, very common when the heart is perfectly sound, we must lay no stress on it as a sign, unless it be combined with other circumstances calculated to confirm the diagnosis. Accordingly, when the sound of the bellows, rasp, or file, persists in the left auricle, either continuously or interruptedly, for several months;—when it is found only there, and exists even in the greatest quietude;—when it is scarcely lessened by venesection, or, when lessened, if it still leaves behind it a degree of roughness in the sound of the auricle,—or, yet more, when the purring-thrill coexists with this,—we may be assured that the left auriculo-ventricular orifice is contracted. If the same phenomena occur, under similar circumstances, in the left ventricle, we may be equally certain that the aortal orifice is contracted.

Three or four times, during the last four years, I have discovered this lesion, by means of these signs. Three similar examples, equally verified by dissection, are recorded in M. Bertin's work (Obs. 49, 50, 51) and a fourth is given in the collection of cases published by Dr. Forbes. (Case VII.) But if these phenomena exist only for a time,
sternum the contractions of the heart are quite different. Here the impulse of the right ventricle is very great, its contraction accompanied by a very distinct sound, and being of the ordinary duration; viz. twice as long as that of the auricle. The sound of the auricle is somewhat obtuse, but without any thing analogous to the vibratory character of the left. The action of the heart is audible below both clavicles, on both sides, but feebly, especially on the right. Over the whole sternum, on the right side and below the left clavicle, the contractions of the heart have the same rhythm as at the end of the sternum. On the left side, on the contrary, the whizzing sound of the left auricle already described is much feebleer than in the left precordial region. From these signs the following diagnostic was given—

Ossification of the mitral valve, slight hypertrophy of the left ventricle; perhaps slight ossification of the sigmoid valves of the aorta; great hypertrophy of the right ventricle. The pulse, in this case, was pretty strong and very regular, and all the functions natural, only the sleep was habitually disturbed by frightful dreams, and the lad could not use any severe exercise, nor even walk rather fast, without being attacked by strong palpitations and a feeling of suffocation. Four venesections, after intervals of a few days, gave much relief. After the first, the pulse became weak; and immediately after each bleeding the purring vibration became imperceptible to the hand, and the whizzing of the auricle changed from the sound of a file to that of a bellows, the valve of which we keep open by the hand; the shock of the right ventricle continued to be very strong. This patient left the hospital after a month, being, in his own opinion, pretty well. He came afterwards several times to consult me, and was bled occasionally. I saw him once more in 1822. I found that he had abandoned his laborious occupation of gardener, and had an easy place as the servant of a priest. Since his change of situation he has been much easier: but his former symptoms still exist, although in a slighter degree.