Clinical Lectures

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BY

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LECTURE V.—ON THE STETHOSCOPE.

Principal Uses of the Stethoscope.—Rules for its Construction: 1, as to Material; 2, Length, Thickness, etc.; 3, Shape, etc., of Extremities—Practical Hints for its Manipulation—Method of Applying—Choice of Whereabouts to apply—Determining Limits of Sound—Ausculting Females and Children.

GENTLEMEN,—You have made a request to me that I would give you a lecture on the stethoscope. To that request I accede with very great pleasure; partly because I think I can on that subject give you some valuable practical hints; and partly because I think there is no subject on which I could discourse to you, having wider or more important practical bearings, or on which we shall have more frequent occasion to fall back in the prosecution of our clinical studies.

The progression of a science is a *per saltum* progression; at one time making vast strides, at another remaining almost stationary. Or it may be compared to the course of a river—its bulk increased by sudden increments; flowing on for many miles without any augmentation of its stream, and then receiving an accession to its waters that doubles its volume. Thus, in the histories of sciences, times now and then occur, when a flood of light is poured upon them from some new source; or when some master mind arises and deciphers the hieroglyphics in which much that was before unknown was written; or when some happy accident suggests a new principle, or the new application of an old one; or when some new instrument, or aid to investigation, subjects to examination and analysis what before was beyond the ken of our senses. The laws of mathematics are brought to bear upon the movements of the heavenly bodies, and suddenly the physics of the universe become an affair of *plus* and *minus*, of roots and powers, of equations and logarithms. Or an Aristotle arises, and the science of Logic leaps, like Minerva, full grown, into existence. Or the motion of the lid of a tea-kettle suggests the idea of the steam-engine. Or the refraction of light by a convex lens serves to analyse the milky way into innumerable suns, or show teeming nations in a drop of water. Such instruments as the telescope, the microscope, and such like, may be said to be the representative instruments of the sciences they elucidate, for the advanced condition of those sciences, to which the instruments have brought them, is indissolubly connected with their discovery and employment. Such a representative instrument is the stethoscope. It is the representative instrument of the science of physical diagnosis.

But we must beware of exaggerating its powers and results; we must beware of that common error that affects the non-professional world, and even, to some extent, a portion of the professional world as well—that there is some mystery about it, that it is an instrument that *makes* sound; and we shall best assist it in its work by assigning to it its true place, and regarding it as a mere *aid* to auscultation—a medium, and not a power—a convenience, and not a necessity.

The principal value and advantages of the stethoscope appear to me to be the following:—

1. In the way of decency, cleanliness, and convenience.

To *decency* the use of the stethoscope contributes by obviating the necessity for that full exposure of the breast and the application of the bare ear to it, which, in the case of young females, would, through the association of shame with that which is sexual, and the sexual purpose of the mammary gland, amount to immodesty. How the use of the stethoscope would contribute to *cleanliness* on the part of the auscultator, I need not remind those who are familiar with the out-patient, and even the in-patient practice of our hospitals. The foul and sordid condition in which the sick members of “the great unwashed” present themselves to us is such as to render it not only intolerable, but often really almost impossible, to touch them. The stethoscope saves us from absolute contact, and, over and above, gives us the advantage of eight inches, or so, of distance. The employment of the stethoscope contributes to the *convenience* of auscultation by obviating the necessity of stooping so much over the patient, by rendering it unnecessary for him to come so near the edge of the bed, by making us in a great degree independent of the patient’s position, and by enabling us to listen to certain parts that the unaided ear could hardly reach, as the axilla, the supra- and sub-clavicular spaces in thin people, and the hollow sternum in some exceptionally formed chests.

2. The stethoscope enables us to circumscribe and localise the sounds that we hear. In proportion to the smallness of the chest-end of the instrument we are able to tell the precise seat of the greatest intensity of sound. If we work towards the sound and then from it—right and left, up and down—we can soon put our finger on the exact spot, and say “there it is”; and we can determine that spot with the greatest certainty—within a quarter of an inch. With the bare ear we cannot possibly do this; not only because the pinna is so large, and therefore gives such ill-defined information as to locality, but because when the head is applied to the chest the sounds are conducted to the internal ear by the bones of the cranium, so that the sound may be very well heard when the ear is not over the part at all. And not only can we by the use of the stethoscope tell precisely where the sound is, but whether it is circumscribed or extended, whether it covers a large or small space. By working the stethoscope round and round, and gradually contracting the circle, we can ascertain its area, and thus learn whether the morbid condition giving rise to it is distributed or strictly localised.

3. By removing the auscultator’s head from the patient’s body, the stethoscope often clears away fallacious crepitating or rubbing sounds produced by intervening hair, the friction of the patient’s clothes

etc. I have often lost a sound very closely representing pneumatic crepitation on substituting the stethoscope for the direct application of the ear to the chest.

4. By modifying and exaggerating the sounds heard, the stethoscope sometimes elicits characteristics and differences, and even the *existence* of certain auscultatory phenomena, that otherwise might escape detection. This advantage especially applies to certain exceptional forms of stethoscopes, and is not an unqualified advantage, because it implies an alteration as well as an exaggeration of the natural sound.

5. Lastly, shall I enumerate among the uses of the stethoscope that it tends to increase the faith of the patient? It implies that the doctor possesses a means of information not in the possession of the bystander. Not long ago I was amused by hearing a lady, and a not unintelligent lady, gently intimate to one of the most distinguished of living auscultators, who having carefully employed immediate auscultation was pronouncing his opinion on the case, "But you have not used the stethoscope?" implying, as far as her politeness would permit her, that auscultation without the use of that mysterious instrument was to her a thing of nought. Anything that increases our patient's confidence is of value; the strict adoption of the advice given often depends upon it.

I have just given you five kinds of reasons for the usefulness and value of the stethoscope. And now let me express an opinion that may seem in direct contradiction to all I have said; namely, that you will often find the naked ear much better. If I were condemned either never again to use the stethoscope, or never again to apply my bare ear to the chest—to give up the one or the other—I would give up the stethoscope. I have oftener found that I have got more certain and reliable information—that my appreciation of a doubtful sound has been more exact, that a half-heard sound has come into clear existence—by substituting the ear for the stethoscope than the stethoscope for the ear. For all the reasons I have mentioned the stethoscope is not only a valuable, it is an invaluable instrument; and its loss to auscultation would be irreparable. Nevertheless, my opinion is, on the whole, such as I have stated it. My advice, however, is, "Employ both means." By doing so you will correct errors on either side, and clear away the fallacies both of the mediate and intermediate method; and rare indeed will be the case in which you will not find their united testimony give you a more certain and reliable information than either of them alone. As a rule, the front of the chest most requires the stethoscope, while the back, convex and broad and free from *impedimenta*, presents the greatest facilities for the application of the ear.

It is not my purpose in the present lecture to give you the history of the instrument, or to settle the relative claims of Hippocrates, Hook, Bayle, or Laennec, to having given to the world the idea of auscultation; or to expound to you the acoustic principles upon which the stethoscope is constructed. My purpose is a very simple one and a very practical one—to enable you to do two things; first, to choose your stethoscope, and then to use it. I shall, therefore, divide my observations under the two following heads:—

a. Rules for the construction and choice of a stethoscope.

b. Practical hints for its manipulation.

And first, with regard to the principles upon which the stethoscope should be constructed, and the qualities which a good stethoscope ought to possess.

There are three principal circumstances that affect the quality of a stethoscope:—

1. Material.
2. Length and thickness.
3. Size and shape of extremities.

1. *Material.* What a stethoscope essentially is, is an instrument which will render audible at a distance from the chest the vibrations of which the thoracic parietes are the seat. What we want to know in using it is, what is going on inside a patient's chest, and the source that we look to for information is the sound or sounds that the healthy or diseased thoracic viscera generate. These sounds are heard, perfectly natural and unmodified, at the surface of the chest; the best stethoscope, therefore, and one that will give the most truthful information, will be that which delivers at its proximal end (*i.e.*, that which is applied to the ear) the sound that the most exactly corresponds with that which it receives at its distal end from the patient's chest-wall; in other words, that stethoscope will be the best, mediate auscultation with which will the most exactly correspond, in the sounds it furnishes, with immediate auscultation. We have, therefore, in this closeness of correspondence, a certain standard of the relative excellence of different stethoscopes.

The material that I believe the best fulfils these conditions, that gives, on the one hand, the smallest amount of loss of sound, and, on the other, the least perversion of sound, is that of which Laennec himself first recognised the value—some porous wood. What is the principle of this? I do not believe it has anything to do, as is often suggested, with the homogeneity of porous wood and lung—with wood being spongy and lung spongy—and a consequent similarity of the vibrating qualities of wood and lung; because we know, in the first place, that the vibrating qualities of healthy spongy lung are almost *nil*, while those of wood are excellent; and, in the second, that the vibrations that the stethoscope receives are not those of the lung, but of the chest-wall. I believe it has to do simply with wood being a good conductor and corroborator of all vibrations; that it depends on the same property in wood which makes it a good substance for fiddles, and for the walls of concert-rooms and speaking-halls.* Cedar is the wood in general use, and there cannot be a better. Deal is cheaper, and equally beautiful when polished. I always use a deal stethoscope. The denser the wood the more does it modify the sound that it transmits, by its own inherent vibrations; the sound that we hear through an ebony stethoscope, for instance, has a peculiar tone about it, widely dif-

* The principle on which wood conducts the vibrations that it receives, pure and unmodified, without the superaddition of any tone of its own and without echo, is much the same, I think, as that on which snow reflects pure white light without image. Each crystal of snow reflects, just as each cell of the porous wood vibrates; but the reflection is broken, and the multitudinous reflections give neither an image nor colour, but simple white light; so, each cell of wood being highly vibratile, and no two vibrating in unison, the aggregate vibration is neutral, and becomes conduction pure and simple, just as the white light of snow is reflection pure and simple.

ferent from that which we should hear from listening to the same sound with the bare ear.

A stethoscope should be made of one piece of wood, turned out of the solid block. The breaking of continuity involved by having it made of several parts, so as to take to pieces, must necessarily impair the perfection of its conducting power. Still more important is it that it should be of one material, and not part ivory and part cedar, as one often sees. There is no end to the absurdities of construction in this respect that stethoscopes exhibit. In some, the ear piece is ivory, and made to screw on and off; the shaft is cut in two in the middle, and each half furnished with an ivory end, the one to screw into the other; the chest-end is covered with an ivory cap, to screw on and off, and in its recesses is contained a little perforated cone of cedar, furnished with a small brass tube projecting some short distance up the centre of the stethoscope. Could anything be less likely to be a good conductor than such a heterogeneous and piecemeal concern? Some stethoscopes break up into as many pieces as a Chinese puzzle, and require as much ingenuity to put them together again. If a striking and compendious illustration were required of the way in which man will, on some occasions, abdicate his reason, I think a table covered with the different forms of stethoscopes would excellently furnish it.

2. *Length and Thickness.* How long should a stethoscope be? Laennec said a foot. His reason for having it so long was that it enabled him to reach the axilla and other remote parts without inconvenience, and to auscultate his patient in bed without stooping much over him. But I think it too long. I think this undoubted advantage more than counterbalanced by the disadvantage of taking about so cumbrous and inconvenient an instrument. At the same time, to make a stethoscope too short robs it of one of its uses. I have a very simple rule as to length; namely, to have my stethoscope just a little bit shorter than the long diameter of the crown of my hat; and for this simple reason, in order that I may carry the one in the other. It happens to be a very convenient and usual length, and even if it were not, this method of portage would reconcile me to it. If the instrument is just the least bit shorter than the crown of one's hat, and after putting it into the top of the hat directly antero-posteriorly a little twist is given to it, it sticks firmly and is safely supported. Some people revile this practice of always carrying about one's stethoscope in one's hat, and call it unprofessional and shoppy; but it has this great advantage, that you and your stethoscope are never far apart; for where your hat is there is your stethoscope, and in this climate a man is as likely to be without his head as without his hat.

With regard to thickness, extreme thickness and extreme thinness have both their disadvantages. A very thick stethoscope is unnecessarily heavy, and a very thin-walled one is, I think, hypervibratile, and gives a modified tone; while, at the same time, it is an extravagantly fragile instrument.

It has been a subject of debate whether a solid stethoscope is best, or one with a hole bored through it. I think myself it is a matter of indifference. I have carefully examined the relative conducting properties of two cedar stethoscopes, of exactly the same size and shape, but one solid and the other

hollow, and have failed to detect any difference between them. Laennec attached great importance to this point. He believed that the central hole was necessary for the conduction of the voice-sounds, while the heart-sounds were conducted best through a solid cylinder, the breath-sounds being audible through both, but best through the hollow instrument. I cannot but think that here this great observer has been guilty of an over-refinement. I find the sounds of the heart conducted as well through a hollow stethoscope as a solid one, and the voice-sounds as well through a solid as a hollow; provided, always, the instrument be of the proper material, and there be no other vice in its construction.

3. *Size and Shape of Extremities, etc.* And now I come to the most important point of all, that upon which the properties of a well- or ill-constructed stethoscope chiefly depend.

First, the chest-end should be small. There is no commoner fault in stethoscopes than having the chest-end too large. There are two reasons why it should be small: in the first place, the smaller it is the greater is the power of circumscription of the instrument, the greater its localising power, the narrower the limits within which it determines the seat of a sound. For it is manifest, if a sound is covered by a stethoscope whose chest-end is two inches in diameter, that the area in any part of which the seat of this sound may possibly be placed is four times as great as if a stethoscope were used whose chest-end was an inch in diameter, and that the smaller the chest-end of the instrument the sooner will the auscultator be aware (in exact proportion to the smallness of the end), in passing to right or left, up or down, that he no longer covers the sound. But a more important reason for the smallness of the chest-end is, that the larger it is the more is its perfect apposition impeded by the inequalities of the chest. It is fatal to auscultation that there should be any chink between the stethoscope and the chest-wall; if there is, and the air within the instrument is not perfectly shut off from communication with the outer air, we get that well known humming noise which we hear on applying a shell to the ear. In a fat chest, or an even chest, or a well fleshed-up chest, a wide-ended stethoscope would not be attended with this special disadvantage; but in a thin chest it would be impossible to maintain perfect apposition, and preclude chinks in the intercostal spaces, the sub- and supra-clavicular regions, and over a very hollow sternum, unless the chest-end of the instrument were quite small.

Fig. 1.

Suppose, for example, that x, x (Fig. 1) represent the prominences of two ribs in a thin

chest, and z the deep intercostal space between them, it is manifest that if the chest-end of the instrument is wide enough to extend from rib to rib it will be so lifted at the edges placed on the ribs (x, x) that in the interval, where the integument sinks in between them, a wide chink will exist (w); just as the *President* steamship, which was lost some years ago, is supposed to have "broken her back," from being so long that her stem and stern rested on two great seas, and so, in the intervening trough, hoisted her out of the water; thus she was unsupported and parted amidships. If she had been half the length this could not have happened, for then she would only have been the length of a single sea, and not two seas, and would have rested in an inclined direction on one or other of them. In the same way, if the chest-end of the stethoscope is so small that it cannot cover two ribs (*i. e.*, not so large that it *must* cover two ribs) it may, by being inclined one way or the other, secure perfect apposition on the most uneven chest; for while one edge is tilted up by the rib the other sinks into the integument in the intercostal space, as shewn in fig. 2.

Another important attribute in the chest-end of a

Fig. 2.

stethoscope is the character of its edge. It is a great mistake to have, as one often sees, a wide, flat edge; the wider and flatter the edge the more difficult, manifestly, its perfect apposition, on the principle I have just enunciated. The edge should be narrow and smoothly rounded, as seen in fig. 3, A; narrow to neutralise the effect of inequalities, rounded so as to prevent any sharpness and obviate pain to the patient. One often sees such a chest-end as is represented in section at fig. 3, B, which is doubly bad; bad from being broad and flat and so producing chinks, and bad from having a sharp cutting edge.

Fig. 3.

The ear-piece should be *large* for the very same reason that the chest-end should be small—to secure apposition and occlusion; for, the larger it is, the less critically exact and central need the apposition of the ear to it be, in order to prevent chinks and a want of coincidence between them. The smaller the ear-piece, the more are divergencies from exact central application attended with imperfect closure. In

fact, it is a very difficult thing so to apply the ear to a very small ear-piece as to produce perfect occlusion.

Moreover, the ear-piece should be *flat*. It is often cupped and hollow; this makes perfect apposition of the ear next to impossible. If there is any divergence from perfect flatness the surface should be rather projecting in the centre than receding; the parts about the centre of the pinna are thus brought into firm apposition with the stethoscope, and perfect occlusion secured. But, on the whole, I prefer that the ear-piece should be perfectly flat.

Fig. 4.

Fig. 4 represents the section of what I consider a very good stethoscope. It is half the "natural" diameter, *i. e.*, one-eighth the size. The ear-piece is flat and broad, and the most careless application of the ear would produce perfect occlusion; the chest-end is small, with a narrow and rounded edge. The measurements are—length seven inches, diameter of ear-piece three, diameter of chest-end one and a quarter, circumference of shaft one and a quarter.

[To be continued.]

ALLEGED DEATH FROM IMPURE VACCINE LYMPH. The Registrar-General reports, in the returns of the week before last, that a child died from the effects of impure vaccine lymph. This registration-fact requires explanation.

GROWTH OF QUEENSLAND. At the date of our own last census—the beginning of April 1861—the population (not aboriginal) of the colony of Queensland was 30,059. On the 30th of September last, it was 41,941; namely, 25,435 males, and 16,506 females. At this rate, the population would double itself in less than four years; but such an increase depends, of course, mainly upon immigration.