others. Therefore, although you should make every effort to make a good diagnosis and apply the best treatment you can, you must be prepared for disappointment. And if you come across cases which have been treated by others, be a little charitable about the treatment they have adopted.

Lecture

ON A

METHOD OF GRAPHIC RECORD

OF THE

PHYSICAL SIGNS IN THE INVESTIGATION OF DISEASES OF THE HEART.

Delivered at the Post-graduate School, New York, on Oct. 5th, 1888,

By A. ERNEST SANSOM, M.D. LOND., F.R.C.P.,
PHYSICIAN TO THE LONDON HOSPITAL.

GENTLEMEN,—Your esteemed Professor, Dr. Andrew H. Smith, having invited me to give an address on a subject connected with clinical medicine, I have determined to request your attention for a short time while I describe the method which I adopt in investigating Diseases of the Heart. You will agree with me that in clinical observations it should be our aim to attain precision in the highest degree possible. There should be precision of observation and precision of record, but you will admit that it is desirable that such precision shall be obtained with the expenditure of as little of precious time as possible, and that the record presented shall be such as can be readily perceived and rapidly comprehended. These desiderata we will do our best to obtain.

We will suppose our patient prepared for examination. Of course everything should be so done as to allay any perturbation on the part of the subject of our observations, but the dress must be removed in so far that the chest is completely uncovered; a warm wrap can be easily adapted so that the back and shoulders and the parts not under our inspection at the moment are protected from cold. The position of the patient may be standing, sitting, or lying in bed, with the back well supported. It is fundamentally necessary that the posture be such that both sides of the thorax are presented in like condition. It is an observation of very ancient origin that the impressions conveyed to the ear are more fleeting than those recorded by that more faithful witness, the eye. I consider it, therefore, of great importance that you should be provided with a pencil, capable of making sufficiently visible marks upon the surface of the skin. An ordinary aniline copying-ink pencil answers the purpose, but the dermatographic pencil made by Johann Faber is much to be preferred. Your patient should be requested not to object to your judicious use of the picturesque method, for a little soap and water subsequently will remove all the traces. If a sensitive person do so object, you may use as your recording instrument a very fine camel's-hair pencil dipped in bland, colourless oil. The rationale of this proceeding I will hereafter explain.

You will commence by a careful inspection of the thoracic surface, and especially the præcordium. If the apex-beat be visible, indicate this by dots of the pencil over the area in which it is observed; if there be visible pulsations in the epigastrium, in the regions of the aorta or pulmonary artery, or the neck, record these by the sign "Pn."; if venous pulsation, use "V.pn."; if with the pulsation there be retraction of the thoracic wall, use the sign "S.retrn."; a notable bulging of any portion of the surface can be outlined by dots.

We now come to *palpation*. The tips of the fingers applied over the region of the apex will determine the question whether the systole of the ventricles is to be felt or not, or whether this is short and sudden or protracted and heaving. Furthermore, in some cases an important indication may be obtained as to the form of the apex; to this end an application of one finger is better. If the finger be actually lifted, it is of course a fair inference that the ventricle is

actually subjacent, though the shock of the systole may communicate a vibration visible beyond this area; at the parts where the finger is thus lifted, an outline corresponding to the apex may be indicated by short broken lines, thus distinguishing from the points or dots used to record the area of visible impulse; in like manner other pulsations as detected by palpation may be recorded by such interrupted lines in other parts of the thorax or neck. If a thrill be felt, this should be indicated in its position by a serrated line; the position it occupies in the cardiac rhythm can generally be readily determined by palpation. The presystolic thrill can be felt to be terminated by the ventricular systole; it comes to an end abruptly, as the systolic and diastolic thrills never do; this can be expressed by a vertical line at the termination of the horizontal serration, the length of the latter having a relation to the duration of the thrill.

We now come to the important evidence afforded by *percussion*. It is needless here to describe the practice of percussion when this is effected in the usual manner, the stroke being made on a finger or fingers of the left hand applied to the surface of the chest. No doubt valuable information is gained with the finger or fingers thus used as a pleximeter, and a finger or fingers of the right hand as a plessor. I have been long convinced, however, that this method is wanting in precision. It is true we can get evidence of an exaggerated or restricted area of præcordial dulness, and sometimes a bulging of the great vessels, if such exist; but we do not get an accurate outline of the heart and great vessels, such as, I am sure, it is possible to obtain. For this purpose we must use another kind of pleximeter. The form which I have introduced, and that which I always employ, consists of a single piece of vulcanite of the shape shown in the figure. A thin, flat, oblong plate, an inch and a half by half an inch, has on its upper surface

FIG. 1.

Vulcanite Pleximeter.

FIG. 2.

a slender vertical column an inch and a half in height, which is surmounted by a smaller plate, three-fourths by three-eighths of an inch, set parallel to the former plate (Fig. 1). The little instrument is held by the fore and middle fingers of the left hand applied on each side of the vertical column, the sensitive tips of the fingers resting on the upper surface of the larger horizontal plate (Fig. 2). The lower surface of this latter is applied to the wall of the chest, and percussion by one or two fingers of the right hand by an even and not too forcible stroke from the wrist is made upon the upper plate. It is obvious that the whole of the pleximeter vibrates with the stroke.

Now it is quite unnecessary, in the description of the use of this little instrument, to enter upon the refinements of acoustics; in fact, I advise you not to think in terms of *sounds*, but rather in terms of *vibrations*. You appreciate these vibrations by the ear and by the tactile sense. My little pleximeter is so constructed that vibrations are communicated directly to the organs best fitted to estimate them—the tips of the fingers. Fix your mind on *vibrations*, whether these be sonorous and you hear them, or mechanical and you feel them, are points of but secondary importance. You commence by applying the pleximeter, with its long diameter, parallel to the sternum, about midway between the axilla and the right sternal border, and eliciting vibrations in this situation. This proceeding in normal conditions gives you the ordinary thoracic vibrations. You then gradually approach the pleximeter nearer the sternum, until you arrive at a line where the vibrations are sensibly modified. By slightly inclining the pleximeter so that the vibrations come from its left edge, this is practically a line—that is, a surface without notable breadth. Here you draw a line with your pencil. By repeating the process at higher and lower levels, and uniting the marks, you thus delimit the right of the area of modified vibrations.

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In like manner, percussing from above downwards, with the long diameter of your pleximeter horizontal instead of vertical, you arrive at the upper limit of the liver, as indicated by the area of modified vibrations.

It is generally thought that the percussion evidence, as regards the area occupied by the heart and vessels, does not extend above the third rib; but you will readily convince yourselves that, by adopting the method I have described, you can obtain a line sloping to the left reaching above the second rib, where it fades into indefiniteness. In percussing the left side of the chest, you begin at the level of the second rib, two or three inches to the left of the sternal border, and approach to the right until you arrive at a line of modified vibrations which will be parallel to that obtained on the right side. On taking a slightly lower level, you will find that the line must be rather sloping towards the left; this inclination to the left side is proportionate to the area occupied by the auricles and the left ventricle. The outline of the apex of the heart is readily mapped out. In cases where the stomach is distended with flatus, only very light percussion is necessary. If you wish to narrow your area of percussion at this point to delimit the apex, you can reverse the pleximeter, percussing on the larger, and applying to the chest the smaller, plate. Over the lower border of the heart there may be some difficulty. In some cases the differentiation from the liver is not possible, and this is seldom important. In many cases, however, the vibrations over the liver and those over the right ventricle are so different that the demarcation is easy. In this way you obtain, as I believe, an actually correct outline of the heart and the vessels as they spring from it; that is to say, the upper limit of this dullness is formed by the right auricle, the pulmonary artery, and the aorta. Any bulging of this upper portion is for the most part caused by the aorta. A projection of this may be distinguished when there are no other signs denoting aneurysmal dilatation. Again, a general fusiform dilatation of the aorta can thus be demonstrated. This is found in many cases of gouty affection, of chronic renal disease, and sometimes in syphilis, when no other signs indicate enlargement of the vessel.

Of course, it may be asked how the process that I have just described can be submitted to actual proof. In the first instance, it can be shown that percussion successively performed in this manner gives rise to figures which are absolutely identical; and, in the second place, allowing for some post-mortem changes, it has been shown in many cases at the examination after death that the outline is mathematically correct. In some forms of dilatation of the aorta, whether saccular or general (fusiform), post-mortem evidence has shown the accuracy of the diagnosis when there have been no other physical signs. It is needless to say how important this is to demonstrate the dilatation of the heart, whether as regards its right or its left cavities. The more or less pointed form of the apex indicates hypertrophy, while the rounded outline indicates dilatation. Again, it is of great importance often when the percussions show a very restricted outline of the heart; this is very marked in some wasting disorders, especially cancer (notably cancer of the œsophagus or stomach) and pulmonary consumption. In fact, I believe it to be a sign of the highest importance in the prognosis of consumption, for if there be evidence of local mischief in one apex or in the apices of the lungs, and the outline of the heart be normal or considerable, the hope of arrest of the tubercular changes is very much greater than when the outline of the heart is small. When such outline is found to be *very small*, and therefore there are indications of a wasted heart, the prognosis may be said to be extremely grave, and the downfall will probably be rapid. Of course, this sign is of still greater importance when it is observed from time to time that the area occupied by the heart becomes on successive examinations smaller. In certain cases the outline on the right side may extend far beyond the sternum and indicate great dilatation of the right cavities; if this coexist with an enlargement of the left area, to or beyond the nipple line, the lesion is usually mitral regurgitation, although aortic disease may coexist; but if whilst the right side shows dilatation the left border is within the nipple line, and the apex not lower than the normal, it is probable that there is mitral stenosis. In some cases of mitral stenosis I have observed a distinct bulging in the situation of the left auricle. In some cases, also, where there are signs of dilatation of the right cavities, I have observed a wedge-shaped area at the lowest part over the right

auricle and to the right, which I can only explain as indicating a distended inferior vena cava emptying into the auricle. Having now obtained a general outline of the heart, we proceed to again percuss over the surface thus delimited, in order to ascertain if there are modified vibrations over particular portions therein. If, in percussing the outline in the way I have just described, the transition from the thoracic vibrations to the modified vibrations over the heart area be very abrupt—that is to say, that very little vibration is elicited at the point where the lines are drawn—it is very probable that there is pericarditis with effusion, or else thickened pericardium; and again, in percussing from above downwards, if fluid occupy the pericardial sac, no differences are to be elicited over the area delimited, absence of vibrations over the whole is very marked. On the other hand, under ordinary conditions, when the pericardium is unaffected on percussing over the delimited area from above downwards, a line will be reached where the vibrations become very different. This line is found practically to commence a little above the ensiform cartilage, and to incline upwards to the left border of the cardiac dullness at the level of the fourth rib or the third interspace. Above this line vibrations are more marked than below; the line indicates a greater density, and, I take it, points out the commencement of the thick wall of the ventricles, the outlined area above it being occupied by the right auricle and the great vessels. In some cases, where there is considerable dilatation of the heart, I am inclined to believe that it may be possible to detect by percussion indurations or calcareous changes in the auriculo-ventricular valves. I know that by this statement I may subject myself to the observation, “*Fortis imaginatio generat casus*”; and I admit that further observations are needed; but in some cases the post-mortem signs have very decidedly confirmed the evidence as to the site and extent of thickening obtained during life.

We now come to record the signs obtained by *auscultation*.

I need scarcely allude to the question of stethoscopes; for localisation it is sometimes better to use the binaural stethoscope, but it is well to accustom oneself to the employment of the ordinary wooden or metallic stethoscope as well. Any accentuation of either of the normal sounds can be expressed by the sign + within the area in which such accentuation is noted. Supposing such accentuation be noticed in the aortic area, you will remember that the most common cause is chronic renal disease, in which condition there is hypertrophy of the left ventricle, with high tension in the arterial system. In cases such as these it is frequent that dilatations of the aorta can be delimited by percussion, as I have just described, when other signs of dilated aorta are not manifest. Supposing the accentuation of the second sound occurs on the left side in the area of the pulmonary artery, you will remember that such usually exists with mitral disease, obstructive or regurgitant; this loudness of the pulmonic second sound cannot be interpreted as an adverse sign, because one can infer from it an adequate systole of the right ventricle; but it is a very important point if, after having observed this accentuation, you on subsequent examinations find the second sound to diminish in intensity; this generally means that the right side is dilated, that there is tricuspid regurgitation, and that in this manner the tension in the pulmonary artery has been reduced. You will now proceed on the surface of the chest to record the murmur you observe. By the sign “S” we mean the systolic murmur. If this is observed at the base on the right side—that is to say, in the aortic area—indicate this by the letter “S” at the point where it is observed; and if it be carried up the vessels to the carotids or be heard in the episternal notch, indicate this by letters or by an arrow showing the direction. If the systolic murmur is heard on the left side of the sternum in the area of the pulmonic valves, you will indicate this by the sign “S” in this position. In many cases it is advisable to map out the area of audibility by short broken lines. Supposing a diastolic murmur is heard, this is to be indicated by the letter “D,” and the point at which its maximum is observed by a larger letter; its direction, also, whether down the left of the sternum or towards the apex of the heart, can be indicated by an arrow. A systolic murmur in the tricuspid region is indicated by the sign “S,” the size of the letter indicating the maximum; and in the mitral area—that is to say, the apex—the sign “S” is to be used if the murmur is systolic. The sign “PrS” is to be used at the point where you hear

the presystolic murmur, and broken lines should be used to indicate the area on which it is observed.

You have thus made upon the surface of the chest of the patient the map or graphic record of the signs observed. It now only remains to copy such record for reference. For this purpose, you take a very small camel's-hair brush dipped in bland colourless oil and trace over the outline you have delineated, marking in all the letters and signs I have just described. The oil used may be olive oil or sweet almond oil. You now simply apply over the surface with gentle pressure a piece of tissue paper, on which the marks made by the oil will be readily imprinted. Placing this on a smooth surface, you go over the outline again with a pencil, and you thus obtain a permanent record of all the signs observed. It is scarcely necessary to say that from this you can, if it be desirable, obtain an exact measurement in centimetres or fractions of inches of the heart area, and you see at a glance the positions of audibility and the lines of conduction of murmurs, and, indeed, of all the physical signs necessary to be recorded. On subsequent examinations, you can obtain outlines which you can compare with the former, and you have the advantage of at once grasping the situation in a much more decided as well as more rapid manner than if you had to take your inferences from verbal description, however accurate they might be. Copies may be multiplied either by placing a sheet of sufficient transparent paper over the surface of the original and tracing thereon, or by interposing carbon paper between the original and a paper of whatever thickness may be desired, and making the tracing with a hard point or style. By the latter plan, the tracing may be copied into the case-books.

I hope it will be obvious that this method, though its exposition may be too long and tedious, really requires appreciably no more time for its execution than any other careful clinical exploration of the heart. It puts in force the well-worn aphorism, "When found, make a note on," and permits the results of your observations to be made in one or two minutes a permanent record.

CLINICAL NOTES ON DIPHTHERIA.

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(Concluded from page 71.)

ALTHOUGH the series of cases reported are but few in number, they enforce certain definite facts in the clinical history of diphtheria. They teach us that the character of the membranous exudation is not of prime value with regard to diagnosis or prognosis, the mere quantity of membrane being no criterion of the intensity of the attack or liability of the patient to laryngeal implication. It has been long known that in the neighbourhood of an outbreak of diphtheria numerous cases of sore throat are found presenting appearances more or less of diphtheritic nature. If such cases be classified, they will be found occupying a curve, at the bottom of which may be placed simple relaxed throat, and at the top the true membranous variety. We may see the same phenomena in an outbreak occurring in a single house: Cases 1 and 2 enforce this truth.

We are so accustomed to look upon diphtheria as distinguished by membranous exudation on the throat that there is danger of our overlooking the other less marked results of the same disease. In other words, may we not sometimes find the disease expressed without its local throat manifestation? I attach much importance to the history of the cases 1 and 2 referred to in this paper. In these outbreaks the extreme glandular enlargement was so decided, so marked, that, as I have stated, if seen alone, without knowledge of the evident cause, mumps would have been looked upon as the causative agent. Seeing these cases of enlarged glands without a trace of throat trouble, one could not refrain from asking the question, May not diphtheria occasionally express itself as affecting glands alone? Some few months past a case occurred to me which appeared to have an important bearing on this question. I was asked to see a child aged nine, who had been poorly for two or three days. I found the child with the left parotid

and the glands at the angle of the jaw much swollen and painful; pulse 120; temperature 102°; no trace of throat mischief. The child had had a well-marked attack of mumps the previous year. The tongue was coated, and there was much cardiac debility; in fact, the little girl, the morning I first saw her, had a severe attack of syncope while I was present. The child continued in much the same state for five days, on the whole getting better. There was no evidence of bowel trouble or symptom that the illness was enteric. The house had been newly built, and had been drained under the supervision of one of our best engineers. But I could not help feeling suspicious that sewer gas was the cause of the illness. The child was removed to another house; the following day there was decided improvement, and a rapid recovery took place. I obtained the services of my friend Mr. Shirley Murphy. He examined the drainage, and reported that a grease trap in communication with the main drain had not been attended to; it had overflowed and was blocking the drain, sewer gas being forced into the house.

About the same time I was asked to see some children convalescing from an attack of varicella, the convalescence being impeded by swollen glands of the neck, with slight pyrexia. There was no apparent cause to account for the swollen glands; no throat trouble could be seen. The children were sent to the seaside and rapidly recovered. Mr. Shirley Murphy examined the house, and reported that there was decided leakage of sewer gas. I have no doubt it was the presence of this poisonous gas which gave rise to an unusual complication in the course of varicella. It must not be forgotten that the glandular enlargement is not in direct ratio to the amount of membranous exudation in any one individual case of diphtheria.

The relation of tonsillitis to diphtheria is often a matter of discussion, and here again we may gain help from a study of the cases I have reported, tonsillitis of a follicular character being found in several instances in which the cause was undoubtedly diphtheria. A few months ago one of the nurses at the West London Hospital had a mild attack of so-called follicular tonsillitis. The throat mischief speedily improved; there was no coalescing of spots, but a few days later symptoms of paralysis supervened, and declared the initial attack to have been diphtheria. There can be no doubt that a benign-looking tonsillitis may be symptomatic of diphtheria. On the other hand, a most severe attack of the same disease may be absolutely without such specific taint. A gentleman aged thirty-eight was seen by me. He had walked home after dining, and had been caught in the rain, getting drenched. Instead of changing his clothes he sat by his study fire reading. The following day he shivered and had a headache. In the evening his throat was sore. He passed a sleepless, disturbed night, and when seen by me in the morning was found to have a creamy membranous deposit on the posterior part of the tonsil. The membrane was limited to the tonsils and did not spread, and there was nothing in the further progress of the case to warrant the opinion that the attack had been more than catarrhal. But the exudation was distinctly membranous. It is a help in the early diagnosis of such cases to know that catarrhal tonsillitis never leaves the tonsils, whereas a tonsillitis of specific origin in numerous instances affects the uvula or soft palate.

It is experience common to all that sore-throats differing in appearance may arise from impure air. It, moreover, appears as if a throat suffering from catarrh were directly influenced by the atmosphere in which the patient might be; in other words, a patient suffering from catarrh or inflammatory condition of the throat and living in impure air, is predisposed to a change in the character of the throat attack, a catarrhal tonsillitis becoming membranous and infectious.

On Oct. 10th, 1888, one of the head nurses at the West London Hospital was taken suddenly ill with shivering, headache, and abdominal pain. Temperature 104°. Her throat felt uncomfortable, but was not directly complained of. The right tonsil was found to be red and swollen. The following day, when seen by me, the general conditions were improved, but the local trouble gave much pain, the tonsils being now extremely swollen. At one part there was a patch of pus or altered secretion. It had not the appearance or character of membrane. The following evening there was a discharge of blood-stained pus, followed by much relief. Two days later, from the spot where the discharge had issued a thin layer of yellow membranous