BOCK'S STETHOSCOPE AS AN AID TO DETERMINING THE EFFICIENCY OF THE MYOCARDIUM.

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EVERY physician is agreed as to the occasional difficulty in estimating the efficiency or otherwise of the heart muscle, which is a factor of paramount importance in prognosis. Cases occur from time to time which present some of the symptoms, such as dizziness or breathlessness on exertion, which are common both to actual flagging of the myocardial power and to vasomotor instability.

In spite of careful inquiry into the history of the case, and in spite of the many accurate methods of investigation which are nowadays at our command, we cannot invariably form a perfectly definite opinion as to the cause of the patient's symptoms.

Any new instrument, therefore, which can help us in our decisions should be of real use to the profession.

During a discussion on the soldier's heart, reported in the *Proceedings* of the Royal Society of Medicine,¹ Dr. O. Leyton called attention to the value of Bock's stethoscope in helping to decide the point in question—namely, whether certain symptoms are arising from disease of the heart or from disease of the vasomotor system. Dr. Leyton also referred to this instrument in the *Lancet* of February 5th, 1916.

As a thorough trial of Bock's stethoscope has convinced me of its undoubted value, a short account of its use in a military hospital may be of interest.

The principle of this stethoscope depends upon the fact that the normal ratio of intensities of the first sound at the apex to the second sound at the base is approximately 2:1. It has now been established that this ratio is frequently altered when the myocardium is affected, and that it may become 1:1.

It occurs to the critic at the outset that some heart sounds are very difficult to hear on account of emphysema or of a stout chest wall. But it must be remembered that this stethoscope is for estimating intensities of sound at the apex and base in the same individual, and that any such difficulty is almost certainly present at both apex and base. That is to say, the stethoscope is a differential one, and it is so made that intensities of sound can be estimated with great accuracy in each case. This is arranged by means of a hole through which the heart sounds pass to the observer's ears. The hole can be increased in size, or entirely obliterated, by turning a screw (attached to the top of the chest-piece) in one or other direction.

To the screw is fixed a small pointer which works round a scale on which, at equal intervals, are the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100. When the pointer is at 100, the hole in the interior of the chest-piece is entirely closed, and no sound reaches the ear of the observer.

To use the stethoscope, the hole is first closed by bringing the pointer to the 100 mark. The chest-piece is then placed over the apex, and the pointer is turned counter-clockwise till it reaches the figure 10. At this mark the heart sounds will be heard with a clearness almost, if not quite, equal to that conveyed by an ordinary chest-piece.

The pointer is again moved round, this time clockwise, until the first sound is indistinguishable; this usually occurs in a normal heart when the pointer is near to the 80 mark.

The pointer is then moved back to 10, and the chest-piece is placed over the aortic base. The pointer is once more moved in a clockwise direction, and the observer's attention is focussed on the second sound, which in a normal heart becomes inaudible when the pointer is in the neighbourhood of mark 45. These figures are those given in the maker's circular which accompanies the stethoscope.

The ratio of intensity, therefore, of first sound at apex and second sound at base may be represented by 80:45.

In order to test the accuracy of the above statement, observations were first made on the hearts of fifty men of the R.A.M.C. They were all young and healthy, their

average age being 24. None of them had as yet been on active service overseas, but they had undergone several months' training at home, so that one was justified in supposing that they represented a series of normal hearts.

As a result of this examination it was found that the average point at which the first sound at the apex disappeared was 77.7. The highest point was 85, and no case gave a reading below 70. The age of the man did not influence the reading—that is to say, a man of 20 gave a reading of 70, and a man of 31 a reading of 80, while the converse was also shown.

The average point for the second reading at the aortic base was 53—a slightly higher reading than that given in the maker's circular. The lowest reading in the series of cases was 45, and the highest 65. Here, again, age was not an influencing factor. In no case was any valvular disease present. In fact, if such is found, the instrument cannot be used, as the bruit obscures the sounds of the myocardium.

The following illustrate the use of Bock's stethoscope in cases presenting symptoms of illness:

CASE I.

Pte. C. H., aged 21; service one year and five months. Stated that after nine months' service in the army he fell into a trench and had concussion of the brain, followed by two "fits." After his recovery he began to have fainting attacks when marching with pack. He was discharged from the army on the grounds of ill health on February 11th, 1916. He re-enlisted on June 15th, 1916, and after a fortnight's service fainted while he was carrying a small load of ammunition. He was sent into hospital. On admission he was found to be 6 ft. in height and very thin. Examination of the various systems showed nothing abnormal. Reading with the Bock stethoscope, 85:45. Tracings with the polygraph at apex, wrist, and neck showed his heart's action to be regular and efficient.

This was evidently a case of vasomotor disturbance giving rise to a feeling of faintness. The following is a somewhat similar case:

CASE II.

Lance-Cpl. H. S., aged 27; service one year and six months. Came to hospital complaining of breathlessness, faintness, and palpitation. He stated that the symptoms began one month after he joined the army, and were liable to be produced by standing at attention on parade for more than a few moments. If the symptoms occurred when he was off duty, he was able, at first, to overcome them by a strong effort of will, but latterly he had been unable to do so.

When examined at this hospital he was in a highly nervous condition. He was kept under observation for twenty-four hours. As might be expected from his history, a thorough examination led one to the definite conclusion that his symptoms were vasomotor in origin. Reading with the Bock stethoscope, 80:40. He was reassured as to the condition of his heart, about which he was anxious, and was sent back to his unit with a note to his medical officer.

One of our difficulties in the army is to convince a man, after careful examination, that his heart is not at fault when he has become deeply imbued with the opposite opinion. The rather injudicious use of the letters D.A.H. (disorderly action of the heart) and V.D.H. (valvular disease of the heart) has hindered the convalescence of many a soldier. It is much better to make use of the corresponding number in the Army List of Diseases. Similarly, in civilian work, if a patient has once been told that his heart is "weak," he carries with him, not unnaturally, an unshakable conviction that he is doomed to an early grave. Unfortunately, he does not get rid of the impression when he joins the army, as the following case will show:

CASE III.

Pte. G. K., aged 23, service five months, complained, on admission, of pain in the legs. He stated that his "nerves were upset" and that he got palpitation easily. He was told by his doctor before joining the army that his heart was weak. He is a non-smoker. There is nothing to record regarding his system generally, and polygraph tracings show nothing abnormal. Reading with a Bock stethoscope, 85:65.

Cases similar to those quoted above could be given in large numbers if space allowed.

The two following cases illustrate findings with the Bock stethoscope in which the ratio is altered to 1:1 and in which there is evidently an involvement of the myocardium:

CASE IV.

Pte. J. W., aged 19, had served since the beginning of the war. On admission he complained of abdominal pain and shortness of breath. He gave a history of enteric in Gallipoli, July, 1915; he was in bed for six weeks and had done no full

duty since. He gave no history of any illness previous to the attack of enteric.

His face was slightly cyanosed and pupils dilated. Breathing quiet; pulse 84; tongue furred; teeth good. Slight "lagging" of upper lid when following the movements of the observer's finger, but no enlargement of thyroid, and no fine tremor. Heart: Apex beat diffuse and feeble; area of cardiac dullness not increased. Reading with Bock stethoscope, 50:50. The impulses were so weak, both at the apex and at the wrist, that tracings with the polygraph were feeble.

CASE V.

Pte. W. G., aged 36, service three months, stated that while drilling six days before he had an attack of palpitation and pain over his heart. In civilian life he was a part-time postman; he said that he had been subject to similar attacks during the past six or seven years. He gave a history of frequent attacks of rheumatism.

The circulatory system was the only system found to be at fault. The apex beat was feeble, and was in the nipple line in the fifth interspace. No valvular lesion was discoverable; pulse 72, regular, but small in volume. Reading with Bock stethoscope, 55:55. Systolic blood pressure 100, diastolic 80, measured with a Tyco's sphygmomanometer by the method of auscultation.

Tracings with the polygraph were very feeble. Both the apex beat and the radial pulse merely gave minute periodic elevations on an otherwise straight line. No satisfactory jugular tracing could be obtained.

There is one point in connexion with the Bock stethoscope which I have had no opportunity of testing satisfactorily in a military hospital—namely, whether, when the systolic blood pressure is much raised, there is an alteration in ratio of intensities, although there may not be any symptoms of myocardial weakness.

In one case which was examined the soldier was suffering from arterio-sclerosis and glycosuria, and his systolic blood pressure was 220 mm. Reading with a Bock stethoscope, 80:75.

CONCLUSION.

In the Bock stethoscope we have an instrument which is helpful in estimating the functional efficiency of the heart muscle. When used in routine examination it may discover latent myocardial weakness, and so lead to further and fuller examination of the heart. This is a particularly useful point in dealing with soldiers' hearts at the present time.

Conversely, when other signs of myocardial weakness are present these may be confirmed by Bock's stethoscope.

REFERENCE.

¹ *Proc. Roy. Soc. Med.*, vol. ix, No. 4, p. 49.

EPIDEMIC CEREBRO-SPINAL FEVER:

THE PLACE OF THE MENINGOCOCCUS IN ITS ETIOLOGY.

(FOURTH COMMUNICATION.)

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It has recently been shown by Hort that the cerebro-spinal fluid in acute cases of cerebro-spinal fever in man sometimes contains a filter-passing virus which is not the meningococcus, but which is nevertheless capable of producing continued fever or death when injected into monkeys.

The filters employed were Chamberland bougies, and the injections were given by the peritoneal route.

Although the number of animals thus injected was small, the results obtained were sufficiently striking to justify further experiment, in view of the unconvincing nature of the available evidence that the meningococcus of Weichselbaum is itself the primary infective agent in the disease in question.

It was therefore decided to pursue the investigation on a

larger scale than had hitherto been possible, and the following summary presents the chief results obtained.

Experimental Observations.

The following general observations apply to the sub-joined groups:

1. In all the human cases providing material for injection the meningococcus was isolated from the cerebro-spinal fluid at some time during the course of the disease—though not necessarily from the sample injected—and in each case the classical biochemical and serological tests were fully satisfied. In all these cases the fluid injected was obtained during the life of the patient.

2. It was found that cultural tests, such as the inability to grow at room temperature and on non-albuminous solid media, were quite unreliable in the case of many strains the identity of which was biochemically and serologically indisputable.

3. The action of chloroform vapour for four hours, as well as preservation at cold-room temperature for from one to three days, did not prevent the ultimate isolation of the meningococcus from the cerebro-spinal fluid of acute cases so treated.

4. Serum agar and serum broth were the media mainly used, the horse serum being in all instances thoroughly tested by control cultivation experiments for sterility with regard to both visible and invisible organisms. The serum was delivered from a graduated distributor, so that known volumes could conveniently be used for each culture.

5. Control single intraperitoneal and subcutaneous injections of monkeys with serum broth and saline respectively had been shown by one of us (Hort) in 1915 not to produce continued fever, or death. In addition to this, during the course of the present work two monkeys receiving each an injection of serum broth containing approximately 10 to 12 c.cm. of serum, the highest dose of serum given throughout, remained unaffected.

6. Whenever the supply of animals permitted, the internal body temperature was taken twice daily for some weeks before injection.

7. The upper normal limit of the daily range of the temperature of the three species of monkeys obtained for experiment had been found by one of us not to exceed about 102.4° F. in, approximately, 150 monkeys.

8. All the filters used in these experiments were prepared, tested, and assembled in the manner elsewhere described by the same observer.

9. In all cases control samples of the cerebro-spinal fluid examined for the presence of the meningococcus were incubated both before and after inoculation of solid media and of serum broth. In no instance, when the solid media so inoculated remained without growth, was the sample declared sterile, *quâ* the meningococcus until repeated negative results had been obtained on solid media from the incubated cerebro-spinal fluid, or from the primarily inoculated serum broth. In several instances it was shown that the incubated cerebro-spinal fluid gave positive results when the solid media inoculated from the fresh fluid remained sterile.

10. This control was also applied to the isolation of organisms other than the meningococcus from the cerebro-spinal fluid, organisms which, because of their character and of the frequency of their occurrence in fluid collected under good conditions, cannot reasonably be looked upon as contaminations in the ordinary acceptance of that term. The Gram-variable diplococcus of Jaeger, the meningobacillus, and, more rarely, the chromogenic Gram-negative diplococci, are cases in point.

11. In the majority of cases providing cerebro-spinal fluid the fluid was collected within the first few hours of the appearance of symptoms, before the inception of specific treatment. These cases are marked with the figure 1 occurring after the number or letter used to designate the individual from which they were obtained.

12. The administration of antiserum or of vaccine was in certain of the cases followed by failure to cultivate the meningococcus from the cerebro-spinal fluid, although the organism had been cultivated and identified from specimens obtained before injection. These cases are differentiated from the former by the figure 2 occurring after the number or letter used to designate the individual from which they were obtained.