both of the ventricles and in scattered masses throughout the tissue. There is also marked arteriosclerosis.

Sections From Other Portions of the Heart.—In addition to those described above, sections were made from various other portions of the heart in order to study the extent of the purulent infiltration and the condition of the blood-vessels.

Those of the first set were made from the left auricular appendix, the septum between the auricles, the wall of the right auricle and the muscoli pectinati of the right ventricle. The left auricle shows no abnormal changes, but the wall of the right auricle with its muscoli pectinati shows a few polynuclear leukocytes in single rows, or small groups, and the nuclei of many of the muscle fibers are shrunken and irregular in size and shape.

Another set of sections was made from the wall of the left ventricle at the left apex, from four separate areas in this wall opposite the septum, and running from the base to the apex, through the papillary muscles, and from the interventricular septum. The first section near the apex shows an adherent antemortem clot attached to the endocardium by means of fibrin. There are many endothelial cells and fibroblasts entering this fibrin in an attempt at organization, and the endocardium is thickened and infiltrated by leukocytes, red blood-corpuscles and fibroblasts. The clot contains masses of fibrin and polynuclear leukocytes and fibroblasts. The muscle fibers next to the endocardium contain numerous large vacuoles, only a mere shell remaining, and the nuclei are frequently shrunken. There is no diffuse purulent infiltration. The five sections from different portions of the left ventricle opposite the septum do not show any marked changes, but the muscle fibers of the papillary muscles near the endocardium show vacuolization. The septum at the apex shows no marked changes, except fatty infiltration near the pericardial surface.

The right coronary artery 6 mm. from the mouth of the aorta shows an interesting condition. The intima is greatly thickened, measuring from 2 to 10 times the thickness of the media adjacent to it, which shows marked atrophy. It contains a moderate number of fibroblasts and two large irregular areas of calcareous deposits. The lumen is completely occluded by a thrombus consisting mainly of red blood-corpuscles and fibrin, but containing groups of organizing fibroblasts and a few polynuclear leukocytes. This thrombus is adherent to the intima from which the endothelium has become detached. A smaller branch of this coronary artery also shows the same thickened intima, and the lumen is reduced to a small irregular channel. The adventitia contains numerous fibroblasts filled with small brown granules of blood pigment, and the muscle fibers of the media show great atrophy. The intima contains scattered polynuclear leukocytes, granular masses of lime salts, and fibroblasts. The same artery nearer the aorta also contains an adherent thrombus of the intima, and shows great thickening of the intima and, just where this is attached to the thrombus, it is highly infiltrated by leukocytes.

SUMMARY

The clinical history of this case indicates that the patient had been suffering from syncopal attacks for a period of seven months. It is difficult to account for these earlier attacks unless we can believe that there were recurrent purulent infiltrations of the bundle of His with damage to the muscle fibers. We found no other lesions of the bundle of His and can only report the patient's condition for about a week prior to his death, together with the discovery of an acute primary purulent infiltration involving the bundle of His.

We desire to thank Dr. H. W. Stoner for the photograph and photomicrographs, and Dr. J. J. O'Malley for assistance rendered.

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Bromids in Confirmed Epilepsy.—W. A. Turner, in the *Lancet*, states that in cases of confirmed epilepsy with mental deterioration the bromids are of relatively little value.

A STUDY OF A CASE OF HEART-BLOCK

WITH ALTERNATION OF THE SYSTOLIC AND DIASTOLIC JUGULAR WAVES*

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So much has been written in the past few years about heart-block that the report of a single case can no longer be considered worth while. My reason for reporting the present case is that it presents a feature which, so far as I can learn, has not yet been described. It is apparent from the wide diversity of symptoms and of tracings in the cases constantly being reported that not all cases of heart-block are alike and there is certainly much still to be learned about the clinical picture the disease presents. Each case recording some new point adds to the sum of our knowledge.

Briefly stated, the phenomenon essential to the diagnosis of heart-block is the dissociation of the rates of pulsation of the auricles and ventricles. This is generally attributed to an affection of the bundle of His along which travels the stimulus from auricle to ventricle. The block may be complete, in which case the auricular and ventricular rates are entirely different; or it may be partial, as in my case, when some of the auricular stimuli pass through to the ventricles. The

Fig. 1.—Showing the variation in the pulse: record taken every four hours.

peculiar feature which my patient presented in addition was an alteration of the systolic wave, (*v*), and the diastolic wave, (*h*), appearing in the jugular pulsations.

REPORT OF CASE

History.—The patient, a white male, aged 75, was admitted to the Touro Infirmary, New Orleans, May 17, 1909, complaining of headaches, dizziness, constipation, belching, and involuntary contractions of the abdominal muscles just before going to sleep. His complaints were of four years' standing. His family history was entirely without interest for the present inquiry. He had always been perfectly well and did not remember any other than the most trifling illness. He had had gonorrhea thirty years ago. He chewed and smoked tobacco moderately and seldom drank alcohol.

Examination.—The physical examination showed a well-developed and well-nourished and well-preserved man. The heart was practically normal in size, the apex being just inside the left nipple and the right border at the right border of the sternum. No murmurs were to be heard. There was a moderate peripheral arteriosclerosis. The urine showed no abnormalities. The pulse showed a considerable range in frequency, beating sometimes at the rate of 30 to 35 and at other times as rapidly as 70 to 75. The heart-rate, counted at the apex, corresponded always with the radial pulse. The variation in the pulse is shown in the accompanying chart (Fig. 1), on which is recorded the rate taken every four hours. On June 12, 1909, he had "a spell of dizziness and almost lost con-

* Read in the Section on Practice of Medicine of the American Medical Association, at the Sixty-first Annual Session, held at St. Louis, June, 1910.

siousness for a second." He was taken to his room and there lay down. Shortly afterward his pulse was found to be 36 and weak. Heart-sounds could not be heard. After two or three minutes the pulse jumped to 72 and became stronger. A few weeks after his admission to the hospital he was transferred to the Julius Weis Old Folks' Home, which is a department of the Touro Infirmary, and has remained under observation during the year which has elapsed. He has continued to complain of frequent dizziness but there have been no more syn-copal attacks.

I was fortunate enough on several occasions to get tracings at the moment of the change in his pulse-rate. Such a tracing is given in Figure 2. This tracing was made October 17, 1909. At the beginning of the tracing the auricular rate was 66 while the ventricular was 33. Every other stimulus from the auricle, therefore, was blocked. The *a-c* interval (the time between the auricle beat and the ventricle beat) was $1\frac{1}{2}$ (expressed in fifths of a second). The normal interval is about one-fifth of a second. At the point marked *x* the block suddenly ceased and all the auricular stimuli passed through to the ventricle. The rates of the auricles and of the ventricles were now both the same, 60. The *a-c* interval continued to be one and a half fifths.

Fig. 2.—Pulse-tracing taken at the moment of change of pulse rate. At the beginning of the tracing the auricular rate was 66, while the ventricular was 33, afterward 60, showing block of every other stimulus from the auricle. No alternation of any waves; *a-c*= $1\frac{1}{2}$; continues the same after disappearance of block.

Fig. 3.—Tracing showing similar block of every other auricular stimulus. Auricular rate 60; ventricular 31.5; *a-c* interval= $1\frac{2}{3}$; no alternation of waves.

Figure 3 shows a tracing taken Feb. 20, 1910. Here there is a similar block of every other auricular stimulus. The ventricular rate was 31 and the auricular rate 60. The *a-c* interval was somewhat longer than on the previous occasion, being one and two-thirds as compared to one and a half. Neither of these tracings presents the unusual alternation of the systolic and diastolic waves. This is seen apparently only in tracings where there is no heart-block. A good illustration is given in Figure 4. Here it is very easy to see in the jugular (the upper tracing) that the waves *v* and *h* are alternately high and low. Thus in cycles 6 and 8 they are high and in 7 and 9 they are low. The alternation is clearer in Figure 5, where the enlargement is greater. The wave *h* is not lettered here but it is the wave following immediately after the *v* and it will be observed that its alternation corresponds to that of the *v* wave. In both of these tracings there is no block, although the slowness of the radial pulse would have led one to suspect its occurrence. The rate of both auricles and ventricles was 46. The delay of the auricular stimuli is evidenced by the increased *a-c* interval—two-fifths of a second.

In order to attempt an explanation of this alternation it is necessary to stop here to inquire into the manner in which these waves are produced. The wave *v* is explained by Mackenzie¹ in this way: The blood (during ventricular systole) "comes mainly from the periphery into the auricles through the veins. When the auricle becomes filled the surplus distends the superior vena cava and jugular, and hence appears in the tracing as a wave." If we assume this as the correct explanation of the occurrence of the wave, then we must, in order to account for the alternation, assume that in some instances there is a greater surplus distending the vena cava and jugular than in other instances, or at any rate the surplus is sent back or held back with varying force. Since there is no reason to think that the amount of blood flowing from the periphery through the veins to the auricles varies so considerably and so regularly in volume from second to second, we are forced to consider that the cause of the alternation must lie in some condition of the auricular wall. It seems probable that a varying tonicity would permit the auricle to be distended to a varying degree. At times, therefore, the auricle would contain a larger amount of blood than

at others, and in consequence there would be a smaller surplus left to distend the vena cava and the jugular. This would make a smaller wave. When the tone of the auricle was greater a smaller amount of blood would be accommodated, a larger surplus would overflow into the vena cava and jugular and a large wave would be caused. The common occurrence of a pulsus alternans in the peripheral circulation presents an analogy which may be used as an argument in favor of the explanation I offer. If there may exist an alternation of the contractility of the ventricle, is it not reasonable to suppose that there may be an alternation of the tonicity of the auricle?

We may now turn our attention to the *h* wave and shall find, as I think, that the cause of its alternation lies in the same variability of the auricular tone. This *h* wave was described by Gibson² and Hirschfelder³ (independently) to the inrush of the blood from the auricles into the ventricles after the opening of the auriculovent-

1. Mackenzie: Diseases of the Heart.
2. Gibson: Lancet, London, Nov. 10, 1907.
3. Hirschfelder: Am. Jour. Med. Sc., September, 1906.

tricular valves, causing the leaflets to be floated up, and bringing about a transient closure of the valves. This explanation is generally accepted. If this is correct, then it is apparent that the condition of the auricular wall will be the chief factor in determining the size of the wave, which will record the influence of this closing of the valves as a wave in the jugular tracing.

The tracing shown in Figure 6 was obtained at the same sitting as that in Figure 4. The plateaus succeeding the *v* waves and preceding the carotid, *c* waves were thought when the tracing was first studied to be due to the auricular contractions. In other words, they were considered to be *a* waves. There was, therefore, apparently an alternating condition of the auricular contractility. This was, however, a faulty interpretation as we shall see in a moment. Such an alternans action of the auricles has been described by Griffith.⁴ It was accompanied by an alternating ventricular contraction.

ure 6, and in comparing it with the other tracing made at the same time, it became evident that the plateaus already mentioned were due not to the auricular contraction *a*, but to *h* plus *a*. The initial rise of the plateau is due to the *h* wave and its level is maintained by the oncoming of the *a* wave which is not visible as an additional rise.

On two occasions I tried to ascertain the effect of atropin on the block. On both occasions I gave 1/60 of a grain hypodermatically and in both instances there was absolutely no result from its administration. Although the radial pulse was slow, (46), and I had expected to find a block present, this was not the case either time. Hence, I am unable to say what effect atropin would have on the block.

I desire to express my obligation to Prof. George Dock, who first pointed out the alternation of the waves.

602 Perrin Building.

Fig. 4.—Tracing made when there was no block, showing the alternation from high to low. Diastolic wave *h*; alternation of *v*; alternation of *h*; *a-c*=2; ventricular rate 46. No block.

Fig. 5.—In this figure the alternation is clearer, the enlargement being greater. Ventricular rate 46; alternation of *v*; alternation of *h*.

Fig. 6.—Tracing obtained at same sitting as Figure 5, showing apparent alternation of *a* waves. The initial rise following the *v* wave is due to the *h* wave and its level is maintained by the oncoming of the *a* wave, which latter is not visible as an additional rise, hence *a-c* cannot be measured. Ventricular rate 46.

Griffith explains the alternately large and small auricular waves as follows:

The primary condition is the alternans action of the ventricles. When the systoles are strong they last long enough to prevent the quickly following auricular contraction from driving the blood freely or at all into the ventricles and so a large wave is seen in the jugulars. When the ventricular systoles are weak they do not last so long, and the auricle can drive its blood in larger amount into the ventricle and consequently the jugular wave will be smaller. It is of course only when the *a-c* interval is unduly long, as it was in this case, that alternately large and small auricular waves could be determined in this way by an alternans ventricular action.

There was, however, no condition of this sort present in my case. On a closer analysis of the tracing in Fig-

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. LEMANN AND BECK AND STOKES

DR. HAVEN EMERSON, New York: I have been much interested in result of experimental procedures or distention of the auricles with saline solutions. If one places a dog under ether anesthesia, and floods the auricles quickly with saline solution, the animal will develop auricular paralysis. But if one makes a slow infusion of the saline solution, there will result a condition of auricular vibration (fibrillation). It has been found that by replacing the blood of any tissue by any of the usual artificial circulation ordinary fluids we alter the tone of that tissue, especially the muscular tissue; therefore it is entirely conceivable that by flooding the auricles with saline solution there results an alteration of the *a* wave such as shown by the study just reported. The analysis of heart-block has been explained as being the result of an alteration of the tonicities of the auricular wall. So far as is known, the tonicity of the blood vessels alters but slowly. It must be

4. Griffith: Quart. Jour. Med., January, 1910.

remembered that the heart muscle has been shown to correspond in every way with the skeletal muscles as regards the output of work and conditions under which work may be done to the best advantage as regards time or load. The heart muscle, however, does not appear to alter in tone so rapidly as do the skeletal muscles. We should consider the possibility that the tone of the muscle of the heart may alternate nearly as does the tone of the skeletal muscles. Until we can prove consistently that certain procedures alter the tone of the heart muscle we must be conservative in accepting such a change of tone as an explanation of or accompaniment of heart-blocks as instanced in the papers read.

Dr. ALBERT E. TAUSSIG, St. Louis: I have under observation a case of congenital stenosis of the pulmonic orifice with a patent ductus arteriosus which shows a phenomenon similar to that described by Dr. Lehmann. The patient is a young man, aged 19, a shoemaker. He is able to earn a good living at his work in spite of his cardiac defect. The heart is enlarged and he has the typical murmur and other phenomena characteristic of stenosis of the pulmonic orifice. The *a* wave in the jugular bulb is exaggerated and shows well-marked alternation in height, especially when he is under the influence of digitalis. Tracings taken some weeks ago show that the radial pulse is about normal, while the jugular pulse shows a high *a* wave which alternates in height. This alternation occasionally fails. Another interesting feature of these curves is that at the same time of the alternation of the *a* wave there is an alternation of the *a-c* interval. The higher the *a* wave the longer the *a-c* interval. This is the reverse of what one might expect *a priori*.

INSTRUCTION OF THE PUBLIC IN ANTI-TUBERCULOSIS MEASURES BY A TRAVELING CAR EXHIBIT

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ST. LOUIS

When the Missouri Association for the Relief and Control of Tuberculosis was formed in 1907 a main purpose of the organization was declared to be the enlightenment of the public on the disease in question by means of lectures, addresses, demonstrations, and exhibits, these activities being a necessary preliminary to a right understanding of the subject thus presented, and

Fig. 1.—Exterior view of antituberculosis exhibit car.

to afford an intelligent basis on which local organization could be brought about.

To the extent that its limited means allowed a consistent effort was therefore made by the association to enlist the interest and aid of local communities through their medical, social and business organizations, and with some success, the medical societies naturally being the leaders and chief supporters of such movements and auxiliary branches were formed in a number of cities and counties of the state. It was found, however, that these bodies tended in time to become listless, and in

casting about for other means of awakening interest in the subject of tuberculosis and its prevention, the idea was conceived that a well-chosen exhibit installed in a railway coach and sent over the railroad lines in charge of a qualified staff would very likely prove to be the most effective form in which such an object lesson could be presented to the public at large.

With this end in view the association early in 1908 made overtures to the State Board of Health suggesting cooperation and joint effort to accomplish this undertaking, but as an outcome difficulties appeared and the negotiations were brought to a close.

Fig. 2.—Interior view of antituberculosis car.

The project, however, was not lost sight of and endeavors were made to secure funds for this purpose, which hope was realized last June when the announcement was made in the Section on Preventive Medicine and Public Hygiene at the annual meeting of the American Medical Association in St. Louis that a check was in hand ample in amount to cover for a limited time the expenses involved in the equipment and operation of the contemplated railroad car service.*

The managers of railway systems operating lines in Missouri were at once approached with representations touching the plans of the association, with the result of securing a prompt response from the St. Louis and San Francisco System, a first-class day coach being tendered with a promise that it would be turned out of the shops in complete order to receive the exhibit as planned, with special devices for hanging and lighting, no charge to be made for the car or for hauling it, while free transportation for five persons would be supplied, if desired, this gratuitous service including even gas, ice, etc.

The St. Louis Municipal Commission on Tuberculosis with generous public spirit offered the free use of their valuable framed exhibit, which it was found could be used to superior advantage in fitting out the car, and acknowledgment of this graceful courtesy was made accordingly.

*The donor of this fund was Mr. Adolphus Busch, a distinguished citizen of St. Louis, who is widely known as a generous giver to many worthy causes. The work of preparing the car for the road in all its details was placed in the hands of a subcommittee composed of Mr. J. H. Lynch, treasurer of the association, Dr. James Stewart and Mr. Robert J. Newton, secretary of the Municipal Commission on Tuberculosis. Miss W. Doyle, assistant secretary to the association, served as advance agent to the car.