PROGRESS IN PEDIATRICS

RÉSUMÉ ON THE CIRCULATORY SYSTEM

J. HERBERT YOUNG, M.D.
NEWTON, MASS.

HEART-BLOCK

The incident of heart-block in acute infectious diseases such as diphtheria, typhoid fever, pneumonia, influenza and endocarditis, is recognized, since the use of polygraphic tracings, as being more and more frequent. Sudden death is not infrequently due to lesions of the a-v bundle; and many cases of bradycardia, especially in diphtheria, are unquestionably caused by complete or partial heart-block, and not by vagus inhibition.

Hecht¹ emphasizes the importance, for the rendering of the prognosis, of determining whether the heart-block is due to an organic lesion of the bundle fibers, or to a functional inhibition of their conductivity. He mentions two illustrative cases, one of diphtheria, the other of measles. Atropin caused no change in the disturbance of the stimulus conduction, merely increasing the sinus frequency, in the diphtheria case; while the disturbance in the stimulus conduction disappeared almost entirely, after atropin in the case of measles. The disturbed conduction persisted unchanged during four months in the diphtheria case; whereas in the measles case it was replaced as soon as eight days later by a nearly normal behavior, and after three weeks by entirely normal conditions. In view of its transitory character, and its reaction to atropin, the case of measles block must be designated, clinically, as functional. Robinson and Draper² have shown by means of the electrocardiograph that in a man with a normal heart, vagus stimulation will cause not only a marked slowing of both auricles and ventricles, but also a depression of conductivity of the heart beat from auricles to ventricles.

HEART IN DIPHTHERIA

Rohmer³ studied the heart by means of the electrocardiograph in several cases of diphtheria, to find the relation of anatomical lesions of the atrioventricular bundle to sudden death, and also with the object of investigating whether diphtheritic myocarditis exerts a specific influence

1. Hecht, A. F.: *Ztschr. f. Kinderh.*, 1912, iv, 546.

2. Robinson, G. C., and Draper, G.: *Jour. Exper. Med.*, 1911, xiv, 217.

3. Rohmer, P.: *Jahrb. f. Kinderh.*, 1912, lxxvi, 391.

on the curve of the electrocardiogram, and if so, how far it may be of prognostic value. Two cases presented clinically the undoubted picture of atrioventricular dissociation, which in one instance could also be demonstrated by means of the electrocardiogram. The heart-block in these two cases appeared two or three days before death and persisted unchanged. The almost complete anatomical integrity of the bundle in these two cases proves that it may be poisoned up to a total loss of its function without this intoxication being anatomically demonstrable. Rohmer believes that specific relations to the diphtheria toxin do not exist and that diphtheritic heart death is not due to an elective damage of the His bundle, although the loss of transmission in a severely affected heart must necessarily act injuriously and make prognosis more grave. Myocarditis in the course of diphtheria produces no change in the electrocardiographic picture unless the heart failure reaches a pronounced degree.

Tanaka,⁴ in studying serial sections of the heart in fifteen children dying during or soon after an attack of diphtheria, found that fatty degeneration of the heart muscle was the most important change. The amount of degeneration of the atrioventricular bundle showed no relation to that of the rest of the heart; in some cases the bundle of His showed fatty or hyaline degeneration, while the rest of the myocardium was nearly free from it, and vice versa. Neither did sudden paralysis of the heart have any relation to lesions of the bundle of His.

Price and Mackenzie⁵ report a case of heart-block in diphtheria associated with auricular fibrillation. This is the first recorded instance of a case of this kind occurring in diphtheria. The heart muscle showed extreme degeneration, but the sino-auricular node and the auriculo-ventricular node and bundle were not involved. Pepper and Austin⁶ have reported a case of complete heart-block in a man 40 years of age, in which there was no demonstrable lesion of the bundle of His, and cite six similar cases previously reported. On the other hand, Cowan, Fleming and Kennedy⁷ report two cases of complete heart-block, one diphtheria, the other malignant endocarditis, and three cases of acute endocarditis with nodal rhythm, in all of which the a-v node or bundle was involved in an acute inflammatory process. Butterfield⁸ reports a case of heart-block with an acute infection of the whole heart including its membranes. Although the whole heart showed a diffuse inflammatory infiltration it reached its greatest intensity in the auriculoventricular node.

4. Tanaka, T.: *Virchows Arch. f. path. Anat.*, 1912, cevii, 115.

5. Price, F. W., and Mackenzie, I.: *Heart*, 1912, iii, 232.

6. Pepper, W., and Austin, J. H.: *Am. Jour. Med. Sc.*, 1912, cxliii, 716.

7. Cowan, J., Fleming, G. B., and Kennedy, A. M.: *Lancet*, London, 1912, i, 277.

8. Butterfield, H. G.: *Heart*, 1912, iii, 203.

SYPHILIS

Recent work of Warthin⁹ shows that syphilis plays a rôle in the etiology of heart disease, the importance of which has heretofore been unsuspected. In the study of a large number of cases of congenital syphilis, he has found fatty degeneration of the heart muscle present in every case, either as a diffuse fatty change or a focal process. The diffuse fatty change is found in the more severe cases of diffuse interstitial change and is associated with the cellular infiltration, fibroblastic proliferation and myxomatous stroma of this form of syphilitic myocarditis. In lesions of this type, spirochetes are always found in great numbers. The focal fatty areas may occur independently of any infiltration or proliferation, or of any vascular obliteration. With hematoxylin and eosin preparations these areas suggest simply an edema with fatty degeneration of the muscle fibers, but examination by the method of Levaditi shows the presence of spirochetes. Warthin believes that colonies of spirochetes associated with focal fatty changes alone represent either a milder or a more acute infection. In very mild or latent infections colonies of spirochetes have been found in tissues showing no histologic changes at all.

It seems probable that these parenchymatous lesions may heal without an interstitial reaction, as focal fibroid areas and focal calcification of the degenerate muscle fibers have been found in a late stage of congenital syphilis. The important fact that spirochetes may be found in the heart muscle and in no other organ has been demonstrated in two cases of congenital syphilis.¹⁰ The fact that the heart may show marked lesions in cases of congenital syphilis, when the liver, lungs and spleen show no changes at all and no spirochetes, has a great practical importance in pathologic diagnosis.

In seventeen fetuses and new-born infants known to be syphilitic by the presence of spirochetes in the principal organs, Rebandi¹¹ found in thirteen of these definite histological changes in the aorta. Even under the low power there is seen an increase in the thickness of the aortic wall, which is chiefly confined to the adventitia and media. The vasa vasorum, some of which appear enlarged and hyperemic, others with a sometimes considerably reduced lumen and abnormally thickened walls, are surrounded by a small cellular infiltration. This infiltration varies in intensity in individual cases, involving the adventitia, the outer layers of the media, very rarely the intima. The lesions are similar to those found in syphilitic aortitis in adults. Spirochetes were found in all cases and their number was in direct proportion to the severity of the pathologic changes. No instance was found in which spirochetes were present

9. Warthin, A. S.: Jour. Am. Med. Assn., 1912, lviii, 409.

10. Warthin, A. S. and Snyder, E. J.: Jour. Am. Med. Assn., 1912, lviii, 689.

11. Rebandi, S.: Monatschr. f. Geburtsch. u. Gynäk., 1912, xxxv, 681.

without histologic change, as Warthin has found in the heart muscle. In mesaortitis, the presence of the spirochetes must usually, though not always, be considered as the efficient cause, but in certain cases the agent of the arterial affection is probably simply due to the syphilitic toxins. Panaortitis is always due to the presence of spirochetes.

Levy-Frankel¹² concludes that congenital syphilis is the most common cause of chronic aortitis, and also believes that the pathologic changes may be either microbic or toxic. He states that the adrenal glands, in all probability, play an important part in the pathogenesis of certain atheromatous lesions which at first glance appear to be referable to rheumatism or chorea. Hypertrophy and hyperplasia of the medullary layer of the adrenal glands were noted in two cases, in conformity with the findings of Aubertin and Clunet, who pointed out the frequent co-existence of medullary hyperplasia in the adrenals of adults with atheroma.

ARTERIOSCLEROSIS

Rittenhouse¹³ has confirmed Hamburger's¹⁴ observations on arterial rigidity in children. His conclusions are based on the examination of 250 well children between 2 and 14 years. No rigidity was found in twenty children at the age of 2 years. Below the age of 7 years, rigidity of the arteries was exceedingly rare, but was found in 50 per cent. of the cases between the ages of 7 and 10, and in 80 per cent. of the cases at the age of puberty. Rigidity of the temporal arteries was commonest under the age of 6, while the radial arteries were more often affected from the age of 7 onward. With one exception, all the children in whom a high degree of arterial rigidity was detected, showed nervous symptoms. No relation between high blood-pressure and arterial rigidity was observed.

BLOOD-PRESSURE IN INFECTIONS

Rolleston¹⁵ has studied the blood-pressure in diphtheria and scarlet fever and concludes that while sphygmomanometry is of considerable theoretical interest, it is of little practical importance except in the convalescence of scarlet fever when nephritis is a complication. In such a case it may give some indication of the severity of the renal lesion. In only twelve out of thirty-three cases of nephritis, however, was the blood-pressure above normal, and the hypertension never extreme nor of long duration. Findlay¹⁶ found that the older the individual and the higher the blood-pressure, the greater the difference in systolic pressure in the brachial and digital arteries. In childhood and youth the systolic

12. Levy-Frankel, A.: *Arch. d. mal. du cœur*, 1912, v, 625.

13. Rittenhouse, W.: *Wien. klin. Wehnschr.*, 1912, xxv, 920.

14. Hamburger, F.: *München. med. Wehnschr.*, 1911, lviii, 250.

15. Rolleston, J. D.: *Brit. Jour. Child. Dis.*, 1911, viii, 433; 1912, ix, 444.

16. Findlay, L.: *Quart. Jour. Med.*, 1911, iv, 489.

pressure in the digital arteries equals that registered in the brachial artery. In adults, on the other hand, and in diseases accompanied by high blood-pressure, the systolic brachial pressure is much higher than the systolic digital pressure. Consequently, pressure readings with the Gärtner tonometer, while unreliable in adults, are reliable in children, except in cases of high blood-pressure.

CONGENITAL HEART DISEASE

In studying, by means of the orthodiagraph, the configuration of the heart outline in congenital heart disease, P. and F. M. Groedel¹⁷ have been able to establish certain distinctive radiographic features in the different types of the disease. Defects of the septum may be recognized precisely by the absence of a change in the configuration of the heart outline. A defect in the ventricular septum can be established on the basis of the peculiar ventricular movements of the margin of the right heart shadow, and be distinguished in this way from a patent foramen ovale. The bulging of the pulmonary artery is characteristic of congenital aortic stenosis and persistence of the ductus Botalli. In the case of the latter, the heart appears in mitral configuration (upright); whereas it lies in the form of a cylinder in aortic stenosis. Pulmonary stenosis furnishes no typical shadow. Of all the congenital lesions of the heart a persistent ductus Botalli gives the most typical x-ray picture.

Wessler and Bass,¹⁸ in five cases of persistent ductus Botalli, found the bulging pulmonary artery as described by the Groedels. The heart in pure patent ductus arteriosus shows no enlargement nor alteration in shape. The presence of such changes suggests an associated or complicating lesion. In mitral disease the pulmonary artery may be enlarged, but it does not pulsate as it does in a patent ductus arteriosus. This shows the necessity of making the diagnosis from a fluoroscopic examination.

ARRHYTHMIA

Friberger's¹⁹ investigations on arrhythmia in healthy children is of unusual interest. These were conducted on 321 unselected school children, between 5 and 14 years of age, and included an examination of the entire body as well as sphygmographic curves. None of these children presented a perfectly regular pulse. A fairly regular pulse was found in 37.4 per cent., a moderately irregular pulse in 50.4 per cent., and a very irregular pulse in 12.2 per cent. The genesis of the arrhythmia was uniform, in so far as the direct origin of the irregularity must be referred to a point of the stimulus-producing and stimulus-conducting system, situated above the auricle. Three principal forms of arrhythmia were

17. Groedel, P., and F. M.: *Deutsch. Arch. f. klin. Med.*, 1911, ciii, 413.

18. Wessler, H., and Bass, M. H.: *Am. Jour. Med. Sc.*, 1913, cxlv, 543.

19. Friberger, R.: *Arch. f. Kinderh.*, 1912, lviii, 30.

noted: (1) In the majority of cases, long pulse beats alternated with shorter ones in such a way that the duration of the wave is gradually lengthened during a few beats, after which it again becomes gradually shortened; (2) the frequency is suddenly retarded at irregular intervals and then gradually increases again; (3) appearance of disorderly, irregular beats, which are about 0.1 second longer or shorter than their neighbors.

The cases not infrequently presented certain irregularities which agreed in no way with the above-noted principal manifestations of juvenile arrhythmias, but rather suggested the idea of extra-systoles, or omitted systoles respectively. In all the curves showing pictures suggestive of extra-systoles, or of sino-auricular block, a distinct respiratory arrhythmia was demonstrable, at least for certain distances; this as well as the extra-systoles may possibly have the same genesis. In no case examined was the respiratory type of arrhythmia altogether absent, and the establishment of this fact is believed to be not devoid of value for the interpretation of the genesis of juvenile arrhythmia.

The higher degrees of arrhythmia are usually found in the younger children. Among children 5 to 6 years old, only 14.3 per cent. had a fairly regular pulse; among the 12-year-olds, 58.0 per cent. had such a pulse; among the 14-year-olds, 50.0 per cent. Arrhythmia was found to be only slightly more common in girls. Height, weight and muscular development seemed to exert no influence on the frequency of arrhythmia. With special reference to the condition of the circulatory organs it is noteworthy that arrhythmia occurs more often with abnormally high, or abnormally low pulse rates, than with the rate which is the rule for that particular age. In a selected group of thirty-four children, presumably having weak hearts, arrhythmia was about as frequent as in the rest of the material. Among nervous children it was only slightly more common than in others. Among children whose hemoglobin was 70 per cent. or less, 98 per cent. showed arrhythmia. In children with habitual symptoms of gastro-enteric disease, arrhythmia is not more common than in other children. The pulse of children varies not only in regard to frequency, but also as to volume, although not to a marked degree. The chief result of this investigation consists in the demonstration of the presence of arrhythmia in all children between 5 and 14 years of age, so it must be considered as being physiological. Juvenile arrhythmia is not a transitory, variable phenomenon, but represents a fairly constant property of the individual in whom it is found. Concerning the causative factors which determine the various degrees of the arrhythmia, the findings fail to afford much information. The age is undoubtedly of importance, as is also the condition of the blood. On the other hand, no special influence seems to belong to differences in bodily development, a mild degree of cardiac weakness, or instability of the nervous system.