

Recent advances in our methods of examination will reduce the number of undiagnosed cases and add to the satisfaction of all concerned in the investigation and treatment of these elusive complaints.

Treatment.—Cases of renal pain will be dealt with, of course, by removal of the cause, when this is possible. Papin and Ambard* point out, however, that in certain cases of painful nephritis, small hydronephroses and renal neuralgias of ill-defined character the only treatment which up to the present has been applied has been either insufficient or excessive. While decapsulation, temporary nephrotomy, and nephropexy are insufficient to effect a cure in a large proportion of cases of this sort, removal of the kidney is too drastic a step. Under these circumstances they have devised an operation which relieves the pain and yet conserves the kidney. This consists in resection of the nerves of the kidney. The pedicle is carefully exposed, the nerve filaments accompanying the vessels are defined, seized one by one with dissecting forceps and torn across by slipping under each a probe-pointed director. The authors state that it is not difficult to distinguish the resistant nerves from the softer lymphatics. Before the operation can be considered complete the vessels should have

**Loc. cit.*

been stripped of all the nerve filaments surrounding them. In order to expose certain of the fibres it is necessary to pass between the different branches of the vessels. The renal vein is in danger of being torn unless care is taken. Should this accident happen, a delicate suture should be used to close the opening. In all cases the kidney is fixed in position by flaps of capsule, and a small drain is placed at the lower end of the wound. The authors publish detailed accounts of six cases so treated, with complete relief in five. After this operation the patient suffers much more than after any ordinary operation on the kidney, even nephrectomy. There is, however, no urinary trouble, neither polyuria nor marked oliguria. Things are just as they are after any operation outside the urinary tract. In these patients, specimens of urine taken from the enervated kidney differed little from those collected from its fellow of the opposite side.

In conclusion, it is apparent that the idea running through this address is that the pain we have been discussing is due in a large proportion of cases to distension of the renal pelvis.

Treatment should be directed towards removing the cause, and involves, in some instances, ablation of the kidney. In selected cases it may be possible to relieve the patient by interrupting the nerves carrying the painful impressions.

A STUDY OF ONE HUNDRED CASES OF CHOREA WITH PARTICULAR REFERENCES TO THE CARDIAC COMPLICATIONS*

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THE purpose of this study is to review a series of cases of chorea with the idea of determining the incidence of cardiac disease in uncomplicated cases and to see what influence the added occurrence of rheumatic fever and other factors may have on the frequency of cardiac involvement. For this one hundred consecutive cases of typical chorea were selected. These patients were treated on the wards of the

Peter Bent Brigham Hospital during the years 1913-1921, inclusive. In every case special inquiry had been made into the personal history with regard to the occurrence of acute rheumatic fever. On discharge every patient was carefully examined to determine just what damage had been done to the heart. A diagnosis of organic cardiac disease was only made after a thorough consideration of all the factors. It is safe to assume therefore, that the diagnosis in these cases represents a fairly accurate approximation of the incidence of cardiac disease. It is recog-

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nised, of course, that in certain patients further evidence of cardiac damage may develop in the future. This applies particularly to the development of mitral stenosis, for I am of the opinion that mitral stenosis can develop insidiously without any further acute infection, while the signs of aortic insufficiency usually appear during or immediately after the acute process.

General Etiologica! Considerations

This group of cases conformed as to sex and age with the generally accepted notions in this regard. There were sixty-six females and thirty-four males, a ratio of two to one. The average age was 13.3 years, the oldest patient being twenty-three and the youngest four years old. The predominance of females is striking when compared with a series of 190 cases of acute rheumatic fever that was similarly studied, in which the ratio of females to males was nearly one to two, *i.e.*, just the opposite to the proportion in chorea. If both chorea and acute rheumatic fever are evidences of a "rheumatic" infection why should girls be attacked by chorea so much more frequently than boys? It may be due to the fact that this "rheumatic infection" is apt to attack the most vulnerable part and that in a general way the most vulnerable part in boys is the joints and muscles, while in girls, particularly at this adolescent period, it is the nervous system.

In considering the etiology of chorea which is by no means settled, there are various factors that are of especial interest when compared with the findings of this study. The relation of heredity to chorea is slight. In this review there was a history of chorea in the immediate family in nine per cent. of the cases. This would seem to indicate not an actual transmission of chorea but the transmission from parents to children of a nervous system of increased vulnerability, or the transmission of an increased susceptibility to rheumatic infection. Poynton¹ says that the "undoubted hereditary tendency of rheumatism makes itself felt in the family history of chorea." There was a history of insanity in the father or mother in five per cent. of these patients. This fact may have some bearing on the importance of a weakened nervous system. It is furthermore impossible to judge what rôle the infectiousness of this disease has in attacking more than one member of the same family. Are they more exposed to the same bacterial cause?

Rheumatism has for some time been con-

sidered an important factor in the causation of chorea. Russell² in 1910 said, "there is abundant evidence that both diseases are microbic in origin and that the same micro-organism is responsible for the clinical manifestations of rheumatism and chorea." It is generally agreed that a certain number of cases of chorea have had acute rheumatic fever. This percentage varies considerably throughout the literature ranging from less than two per cent. to over eighty-five per cent. The wide variation is chiefly due to a difference in definition of the term "rheumatism." Koplik³ says that rheumatism should include beside acute rheumatic fever, the common joint pains and growing pains which he regards in children as definitely rheumatic in origin. Other authors limit the term to clearly defined cases of acute rheumatic fever. As Mackintosh and Anderson⁴ point out, if only the definitely diagnosed cases are included the percentage is too low and if all cases with a history of muscle or joint pains are included the percentage is too high. Thayer⁵ in 789 cases found rheumatism in the past history in 21.6%. Osler⁶ in a series of 554 patients found a history of acute rheumatic fever in eighty-eight or 15.8%. In an additional thirty-three cases there was a history of acute rheumatic pains. This brings the total to nearly twenty-two per cent. The Collective Investigation Committee⁷ of the British Medical Association, in reporting a series of 439 patients with chorea, found 116 which gave a definite history of joint affection with fever, and twenty-six doubtful cases making a total of 142 patients or 32.5%. St. Lawrence⁸ in an intensive study of sixty-five children under observation for an average period of four and one-half years, found forty-one cases of chorea, nine or 21.9% of which had acute rheumatic fever. In most instances where only the definitely diagnosed cases of acute rheumatic fever are included the percentage is surprisingly close to twenty per cent. In this series there was a history of definite acute rheumatic fever in twenty per cent. of the cases. In addition there were fourteen patients who gave a history of joint pains. This brings the total possible cases of preceding rheumatism up to thirty-four per cent. As a matter of fact probably both chorea and acute rheumatic fever are signs of the same infection, so that it is quite incorrect to speak of one as the cause of the other.

Other diseases that may be mentioned in relation to the cause of chorea are scarlet fever, ton-

sillitis and syphilis. Scarlet fever is claimed by some to be an important cause of chorea. If scarlet fever is regarded as another type of rheumatic fever, it may have the same relation to chorea that acute rheumatic fever has. Scarlet fever occurred in the past history in eighteen per cent. of these cases, but in only one instance did the attack of scarlet fever seem to bear any relation to the chorea. In this case the scarlet fever developed while the patient was under treatment for chorea. Tonsillitis, which also may be regarded as an evidence of "rheumatic" infection, and which is variously regarded by different writers in its relation to chorea, occurred in thirty-four per cent. of these cases. Many cases of tonsillitis particularly in children, are overlooked so that this factor may be more important than is generally believed. Milian⁹ of Paris, found evidence of syphilis in seventy-five per cent. of his patients. This finding is not supported by more recent investigations. A positive blood Wassermann has been found in from four to seventeen per cent. of cases variously reported. Serological examination of the spinal fluid has been negative in all of a number of reported instances. In this series there was a positive blood Wassermann in 11.6% of the patients. As this is about the usual finding of positive Wassermann tests in our hospital cases¹⁰ it seems unlikely that syphilis plays any rôle at all in the causation of chorea.

It is interesting to note that in four cases in this series there was an absolutely negative past history; *i.e.*, four children had been perfectly well before the attack of chorea. Two of these cases developed organic cardiac disease. In neither of these patients was there any joint or muscle pains either in the history or during the course of the chorea. Whereas there are many cases in which the cardiac damage was in my opinion due to the chorea, in these two patients with a history of no other infectious diseases we can feel sure that the chorea alone was responsible for the cardiac involvement. Some observers still question the part played by chorea in the production of heart disease. One difficulty in answering their contention has been in finding cases like these mentioned above in which chorea could be shown to be the only possible cause of the endocarditis. Fright or any strong emotion may act as the exciting cause of an attack of chorea. In this series there were eighteen cases in which the onset of the disease dated from some sudden fright. It is interesting that

the report of the Collective Investigation Committee of the British Medical Association⁷ gives twenty per cent. as the number of cases in which fright seemed to play a part. Fright is never the sole cause. Poynton¹ mentions the fact that there was no appreciable increase in the incidence of chorea in London during the air raids, when if fright alone were ever the cause it surely had every opportunity and should have been expected to operate.

Cardiac Complications.—The incidence of cardiac disease following chorea varies in the different series reported. This variation is due to several factors. Some authors have included only those cases in which the endocarditis developed during or immediately following the first attack of chorea, others have included cases who have had repeated attacks of chorea and rheumatic fever, while still others have reported cases examined from two to four and one-half years after the chorea. The accompanying table summarizes their reports.

TABLE I

| Author | Total number of cases | Percentage that developed cardiac disease |
|--------------------------------------|-----------------------|---|
| Koplik (3)..... | 319 | 72 |
| Fraser (11)..... | 300 | 63 |
| Osler (6)..... | 140 | 51 |
| St. Lawrence..... | 41 | 39 |
| Abt & Levinson (12)... | 226 | 37 |
| Branson (13)..... | 67 | 33 |
| Collective Investigation Com. (7)... | 439 | 31.4 |
| Helmholtz (14)..... | 138 | 26 |
| Thayer (5)..... | 689 | 25.4 |

From this table we see that in a total of 2,359 cases of chorea there was organic cardiac disease in 953 or 40.3%. This means that two-fifths of all cases with chorea will have organic heart disease. In our series of 100 cases there were forty-five instances with organic cardiac disease. It is interesting to compare in this connection the findings in the series of 190 cases of acute rheumatic fever previously mentioned, in which there was organic heart disease in only 38.1% of all cases. This emphasizes again what Osler said in 1892 in a discussion on chorea at the meeting of the American Pediatric Society "there is no other disease in which endocarditis is known to be so frequently associated and no other disease in which post-mortem records show such a large proportion of endocarditis."

The type of cardiac disease produced was in every case an involvement of the valves; in a few cases there was further cardiac damage, such as pericarditis or actual myocarditis. The signs of

involvement of the whole heart, pancarditis, did not occur as frequently in this series as in the group of 190 cases of acute rheumatic fever. There was only one case of pericarditis in this series while in the acute rheumatic fever patients there were thirteen such instances or 6.8%. Myocardial involvement as determined by conduction defects occurring during the acute illness was not as common during chorea as in acute rheumatic fever. In the chorea series partial or complete heart block occurred in only one case, or 2.2% of those patients in whom electrocardiograms were taken. In the acute rheumatic fever patients on the other hand, heart block occurred during the hospital stay in fifteen per cent. of the cases so studied. It seems from the above findings that although the incidence of cardiac involvement in chorea is greater than in acute rheumatic fever the extent of the cardiac damage is less.

Effect of Recurrences.—Recurrences are common in chorea and naturally with repeated attacks of chorea the incidence of heart disease increases. In this connection it must be remembered that there are many undiagnosed cases of chorea. Just as rheumatic fever may be represented by mild transitory pains in the joints or muscles so chorea may consist merely in a spell of nervousness, irritability or fidgets. These undiagnosed cases undoubtedly falsify to some degree the statistical incidence of heart disease. This is particularly true in those cases in which a mitral stenosis is found with no history of acute rheumatic fever. Undoubtedly this valvular lesion is the late result in some cases of an undiagnosed chorea. Thayer's⁵ figures in regard to recurrences are interesting.

| | <i>Single Attack</i> | <i>Two Attacks</i> | <i>Three or More Attacks</i> |
|--|--------------------------|------------------------|----------------------------------|
| Number of cases of chorea. | 499 | 163 | 137 |
| Number of Cardiac Lesions. | 85 | 42 | 43 |
| Percentage of Cardiac Lesions. | 17% | 25.7% | 31.3% |

In twenty-nine per cent of the patients in this study there had been recurrences of chorea. The incidence of cardiac disease was higher in these twenty-nine cases than in the group as a whole or in the cases without previous chorea. In the whole group, forty-five per cent. of patients had cardiac disease, in the twenty-nine cases with previous chorea fifteen or 51.7 per cent. had heart disease, and in the seventy-one cases with only one attack of chorea thirty or 42.2 per cent. had a

diagnosis of organic cardiac disease on their discharge from the hospital.

Effect of Other Infections.—The incidence of cardiac disease was much increased in those cases who had had acute rheumatic fever. Of twenty such cases, fourteen or seventy per cent. had heart disease, while of the remaining eighty cases only thirty-one or 38.7 per cent. had cardiac involvement. Thayer⁵ in a much larger series of cases found much the same thing. The converse of this is also true in the series of acute rheumatic fever cases, the incidence of cardiac disease was greater in those who had had chorea. Certainly the occurrence of acute rheumatic fever and chorea in the same patient renders the likelihood of cardiac disease very great.

The occurrence of tonsillitis did not seem to increase the incidence of cardiac disease. Of thirty-four cases with a history of tonsillitis or sore throat, fifteen or 44.1 per cent. had organic cardiac disease.

The Influence of Fever.—The temperature during the attack of chorea may or may not be elevated. Many cases are afebrile throughout; others show slight elevation of temperature, and in some few patients a hyperpyrexia occurs. The latter group was studied to determine the incidence of organic heart disease in the febrile, as compared with the afebrile cases. Since this series is made up almost entirely of children and young adults minor elevations of temperature were disregarded as of too common occurrence at this age to indicate a febrile reaction. The cases were divided therefore into those with temperatures of 99° or less and those with temperatures over 99°. Of the forty cases with temperatures over 99°, twenty-two or fifty-five per cent. had organic disease. Only 38.3 per cent. of the sixty cases with temperatures of 99° or less had such a diagnosis. The occurrence of an elevation of temperature during an attack of chorea would seem therefore to increase slightly the likelihood of cardiac involvement. It is to be remembered of course that endocarditis may occur during chorea without any elevation of temperature. Of the forty-five patients in this whole series who developed organic heart disease only twenty-two had temperatures over 99°. This whole question is of particular interest when considered in relation to the idea that chorea in some cases may be a functional neurosis.

Such afebrile cases have been cited as evidence that chorea is a functional condition. In

a functional disease of the nervous system, however, one would not expect such a large incidence of a type of organic cardiac disease that has the appearance of infection. I believe that the clinical picture of the disease that we know as chorea is due to an infection which involves the central nervous system and often the heart.

Valvular Involvement.—In the forty-five cases of organic cardiac disease the mitral valve was involved in forty-four and the aortic valve in only five cases. In the series of 190 cases of rheumatic fever there were seventy-two instances of heart involvement and of these fifty-six had mitral and thirty had aortic disease. When these two groups are compared the greater frequency of aortic involvement in the rheumatic and of mitral involvement in the chorea group becomes apparent. This is another difference between chorea and rheumatic fever that must be explained if these two diseases are to be regarded as being caused by the same infection. The more frequent involvement of the aortic valve in acute rheumatic fever may be explained in part by the fact that in acute rheumatic fever males are much more commonly attacked than females and it is true that all types of aortic disease more often affects males than females. This is not the entire explanation, however, as in the thirty-four males among the chorea cases the aortic valve was involved in only two cases, or six per cent., whereas in the 119 males in the acute rheumatic fever series the aortic valve was involved in twenty-six cases or twenty-two per cent. The type of rheumatic infection responsible for chorea seems to have a special predilection for the mitral valve.

Heart Irregularities.—The electrocardiographic examination of the heart in these cases showed a much lower incidence of the signs of myocardial involvement than appeared in the group of acute rheumatic fever patients. As mentioned before in this series there was evidence of impaired conduction in only 2.2 per cent. of patients, as compared with fifteen per cent. in the rheumatic fever cases. It is interesting to note that the one chorea case that showed delayed conduction died about five days after this sign appeared.

Permanent heart block of any grade is usually regarded as a serious and progressive disease. There was one patient included in the series of acute rheumatic fever cases that is of interest in this regard. This man had acute rheumatic fever in the Peter Bent Brigham Hospital in 1915.

During his illness he developed an aortic regurgitation and electrocardiographic evidence of delayed conduction. He made a good recovery and at the time of his discharge from the hospital his auricular-ventricular conduction time was .32 seconds. He was cautioned to limit his activities as much as possible. Following his discharge he felt perfectly well and has since been working very actively as a city salesman. On re-examination in May, 1922, seven years after his attack of acute rheumatic fever, he shows the typical signs of an aortic insufficiency and his electrocardiogram discloses a P-R interval of .32 seconds. In every other regard he is absolutely fit and has never had any symptoms of myocardial insufficiency. Apparently what ever damage was done to his conducting apparatus has not been progressive.

Although chorea and acute rheumatic fever are probably evidence of the same infection, involving different systems, the effect on the heart is somewhat different for the two diseases. The incidence of cardiac involvement is greater in chorea but the extent of the damage to the heart muscle seems less than in acute rheumatic fever. In the latter there is a much more frequent occurrence of such evidences of generalized heart damage as heart block, auricular fibrillation and pericarditis. Chorea attacks females twice as often as males while rheumatic fever affects males twice as often as females. Possibly the susceptibility of the nervous system of the one and the articular system of the other explains this discrepancy. The greater incidence of mitral disease in chorea and comparatively greater occurrence of aortic disease in rheumatic fever may be partly explained by this sex discrepancy for in males the aortic valve is much more often involved than in females no matter what the causative agent may be. That this is not the entire explanation is evident from the fact that even among males chorea affects the aortic valve much less commonly than rheumatic fever.

Summary.—One hundred cases of chorea and one hundred and ninety cases of acute rheumatic fever were analyzed, from which the following deductions were made.

1. Twenty per cent. of the chorea patients gave a history of previous acute rheumatic fever.

2. The incidence of organic heart disease in chorea was forty-five per cent., while that in rheumatic fever was thirty-eight per cent.

3. Recurrences of chorea increased the likelihood of cardiac involvement.

4. When chorea and acute rheumatic fever had occurred in the same individual the incidence of cardiac complication was greatest, *i.e.*, seventy per cent.

5. Tonsillitis did not seem to affect the occurrence of organic heart disease following chorea.

6. Fever during the chorea slightly increased the likelihood of cardiac damage, although it seemed that endocarditis could develop in a patient with an afebrile course.

7. The aortic valve was much more rarely involved in chorea than in the rheumatic group, while the mitral valve was much more commonly affected.

8. Evidences of generalized heart damage such as pericarditis, conduction defects, or auricular

fibrillation were much less common in chorea than in acute rheumatic fever.

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OBSERVATIONS ON TETANY*

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DURING the past year the writer has had the opportunity of studying four adult patients with tetany. A summary of the clinical history is given here. My chief interest has, however, been in an investigation of the concentration of some of the inorganic components of the blood in these cases. The results of these determinations are presented in the present paper and their significance discussed. Three of these patients suffered from "gastric tetany," the result of pyloric obstruction. In the fourth patient tetany followed the intravenous administration of sodium bicarbonate during an attack of acute nephritis.

SUMMARIES OF THE CASES

A.—Patients with "gastric tetany."

(1) J. W., Age 28.—Male.—Admitted March 3rd, 1921—"Stomach trouble" for past year. Examination on admission suggested pyloric obstruction. Vomiting a prominent symptom. On March 6th complained of tingling, numbness and cramps in extremities. On March 7th, while

having stomach washed out, he complained of cramps in arms and feet. Five minutes later he went into a tetanic convulsion affecting muscles of face, extremities and abdomen. Conscious throughout. On March 8th patient still complained of cramps. Blood was taken for chemical examination and showed the following findings. Serum: sodium, 287 mgs. per 100 cc; chlorides, 3.55 gms. as sodium chloride per litre; calcium, 10.6 mgs. per 100 cc. Plasma: bicarbonate CO₂, 103 vols. per cent. Calcium lactate, gms. 4 to pint of water was administered by mouth as well as a solution of calcium lactate (gms. 4 to pint) in normal saline by rectal drip. On March 9th he was given a subcutaneous infusion of normal saline. There was no return of symptoms of tetany after March 8th. On March 10th the man was operated on, and a carcinomatous growth producing pyloric obstruction was found. The patient recovered from the operation and was discharged having had no return of his symptoms.

(2) G. S., Age 40.—Male.—Admitted January 28th, 1922—History of "stomach trouble" for past ten years. Ten days previous to admission symptoms became acute with frequent vomiting. On January 27th he took the train to Baltimore for the purpose of entering the hospital. Dur-

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