Poliomyelitis : new facts concerning its etiology, early diagnosis and treatment / by Tom A. Williams.

[Reprinted from
MONTHLY CYCLOPÆDIA AND MEDICAL BULLETIN
Nov., 1910.]

POLIOMYELITIS; NEW FACTS CONCERNING ITS ETIOLOGY, EARLY DIAGNOSIS AND TREATMENT.

BY TOM A. WILLIAMS, M.B., CM., Edin.,
Corresponding Member of the Société de Neurologie de Paris; Neurologist to Epiphany Free Dispensary, etc.,
WASHINGTON, D. C.

WITHIN the last decade, over eight thousand cases of this disease have occurred; and, of these, five thousand were in the United States of America. It is likely that at least a thousand people have been attacked in Pennsylvania alone this year; and in the District of Columbia a committee appointed to study the outbreak there has cognizance of over five hundred cases.

Thus, the situation is a serious one; and every new fact bearing upon the disease should be carefully weighed by each of us, until we have found means to prevent the spread of infection or have discovered a method of arresting the invasion before the nerve elements are destroyed.

Etiology and Pathology.—The disease is not a primary atrophy of the anterior horn cells from acute toxæmia. It is a constitutional disease due to a living virus which causes an inflammation of the connective tissues of various organs, including the lymph glands and intestinal follicles. It is accompanied too by congestion of the spleen and of the mucous membranes. The meninges are inflamed, and the whole central nervous system is more or less hyperæmic. The destruction, however, vastly preponderates upon the region of distribution of the anterior spinal arteries, which supply the anterior cornua, the injury to the motor cells in which produces the paralysis.

Those cells around which the inflammation is not so severe as to produce more than œdema quickly recover as the invasion ceases; and this accounts for the rapid return of power in some cases. Other cases where return of power is less rapid are accounted for by the reintegration of a destroyed axone the pyramidal cell of which has escaped necrosis. In other cases it is the fibers of the pyramidal tract which are mainly involved as they proceed toward the cells in the cornua, which themselves in part escape. Such a case is characterized by exaggerated reflexes and sometimes by Babinski's toe sign. Still another set of fibers may receive the chief impact; I refer to the rubrospinal fibers, which also pass to the anterior cornua cells, through which they regulate muscular tonus. The loss of their influence leads to hypotonia and tremor, without paralysis so long as the pyramidal cells themselves are not implicated. Of course, the clinical picture may vary in different parts of the body in

accordance with the differing incidence of the inflammatory exudate upon different segments of the cerebrospinal axis; and, in the same segment, some cells may escape where others are attacked.

Conveyance of the Disease.—The salivary gland has been used by Levaditi to convey the disease from one monkey to another. In the Rockefeller laboratory they have conveyed the virus by spraying into the nares an emulsion of nasal mucous membrane from a diseased animal. The most infectious material, however, is the spinal cord. The cerebrospinal fluid is infective only for a few days.

Carriers.—It is believed that the disease may be conveyed by the medium of a healthy carrier.[1] Some hold very strongly that abortive, undiagnosed cases are responsible for the spreading of the disease so widely. If this is the case, isolation of ascertained cases must be of little avail, especially as there are other facts which seem to point to the superfluousness of isolation *as at present conceived* against this disease. An instance will make this clear.

Non-contagiousness.—A child aged 11 was attacked with acute paralysis at Bethesda, Maryland, this summer. She had been playing out of doors all day long for weeks with seventeen younger children, seven of whom were her own brothers and sisters. All of these were under careful observation by Dr. John Lewis, the Health Officer of the district, with whom I later saw the case. Not one of these children developed any sickness which would in the least point to poliomyelitis. No contact with another case could be traced, and none of the children had been to town for some weeks. It was the first case recognized at the time in the neighborhood.

Again, in the Washington Children's Hospital, some twenty-five cases of poliomyelitis have been admitted this summer, many of them in the acute stage. They were placed in the common ward, and at first no special precautions against infection were adopted. No patient in the hospital contracted the disease at that time. Latterly, spraying the nares has been employed, and a certain isolation has been maintained, in spite of which I understand that one case of poliomyelitis developed recently in a child soon after it left the hospital.

I need not instance further, for the number of examples where intimate contact has not led to contagion is legion.

Contagion.—On the other hand, instances where known single contact has led to the disease are not lacking. The Stromsburg, Nebraska, outbreak is the most striking example; and another has just occurred, and was observed by myself, during our study of the Washington epidemic.

At McKendrie, Md., in the practice of Dr. A. H. Perrie, the child of a railroad brakeman became febrile and paralyzed on August 1st. Fourteen days before, she had visited Chesapeake Beach, to which many Washington people resort. Nine days later, this child's cousin was attacked. The contact consisted of a visit to a church fair where the children were together some hours. In the

[1] Nebraska epidemic, Dr. C. A. Anderson; Ohio outbreak, Dr. Frost, U. S. P. H. & M. H. Service.

meanwhile, the doctor's own daughter, about August 8th, was attacked by the disease, and later still another family who had been in contact had one child paralyzed. In the Washington report will appear the full history of the epidemic.

Proper Isolation.—It is manifest from facts of this nature that either, 1, the number of immunes to this disease is very great, or, 2, that certain bodily states render infection possible, or, 3, that the manner of conveyance is very different from that against which precautions are being taken by those who advocate isolation. *Proper* isolation would consist of closing of the avenue of infection, and, as we do not yet know this in nature, only isolation from everything can possibly safeguard. It is possible that the disease is really conveyed by an insect either as carrier or intermediate host. No one can forget the complete failure of quarantine to prevent the spread of yellow fever until the false belief that it was carried by fomites was supplanted by the knowledge of its conveyance by the Stegomyia fasciata. Another instance is the very simple conveyance of Texas cattle fever by the Boöphilis bovis tick under conditions formerly thought so extraordinary.

Is Noxa Protozoan?—Besides, evidence is not wanting to support the hypothesis that the infective agent may be a protozoön, in which case an intermediate insect host would be presumptive.

This evidence consists of the nature of the pathological reactions of the central nervous system. That there is a lymphocytosis of the cerebrospinal fluid during the acute phase is now well known. But no thorough study of the cytology either of fluid or neuraxis has yet been published. From 11 cases in different stages of evolution the subarachnoid fluid has been taken by the Washington Committee. A complete study of the cells has been made by Drs. Hough and Lafora. The method used is the precipitation of the cells by absolute alcohol, the imbedding of the precipitate, and its section and staining as if it were a tissue. Even in the earlier stages there is some pleocytosis. The polymorphonuclears are abundant (15 per cent.). It is likely that they originate in the meninges themselves on account of the inflammation there. After a few days, these cells are less numerous, and the pleocytosis consists mainly of lymphocytes, with some plasma cells. In some cases, mast cells are found. It is phagocytic macrophages which cause the disappearance of the polymorphonuclears. As many as twenty may be found digested in a single cell, where they exhibit pyrominophile and fuchsinophile reactions, and may assume forms resembling the Leishman-Donovan bodies found in some protozoan diseases. In the acute phase it is usual to find altered erythrocytes due to minute hæmorrhages where the inflammation is intense. Later on, altered lymphocytes, körnchenzellen, etc., occur.

A moderate increase of pressure was found early in the disease; and there was usually an increase of the protein content sufficient to react positively both by the methods of Nonne-Apelt and Noguchi.

No bacteria appeared in the stained preparations. Hough and Lafora are of the opinion that these appearances are in favor of the protozoan nature

of the virus of poliomyelitis. Their researches will be fully reported in Folia Neurobiologica, and along with the report of the Washington Committee.

Early Diagnosis.—The *earliest symptoms* are usually one or more of the following: great weakness with apathy or irritability, sometimes including photophobia; sometimes slight coryza; marked insomnia is often present,[2] and this in a child without fever or intestinal trouble should excite suspicion. When this is followed by great weakness, and restlessness later occurs, suspicion is still stronger, and, when profuse perspiration begins without a very high fever, I believe that the diagnosis should be made, more especially if any reflexes have diminished or Kernig's sign occurs.

Cases of poliomyelitis have often been called *rheumatism.* This is on account of the severe pain and great tenderness which occur when the meninges are much inflamed. The distinction, however, is quite easy; for in acute rheumatism the joints themselves are inflamed, and hence are hot, red and swollen; whereas in poliomyelitis there is no special heat, redness or swelling of the joints or limbs. Besides, there is always a modification of the reflexes in poliomyelitis, and as soon as the horn cells of any segment are invaded the reflex arising in that segment is first diminished and later suppressed, often several hours before paralysis occurs. When the attack is mainly on the pyramidal fibers, either in the affected segment or high up in the cord, the reflexes may be exaggerated in that part of the body supplied by those fibers. Again, before the meningeal inflammation has extended to the cord, there may be for a time an exaggeration of reflex activity.

Diagnosis from Cerebrospinal Meningitis due to the Diplococcus Intracellularis. The Cerebrospinal Fluid.—In cases where restlessness and hypersensitivity usher in the illness this diagnosis is sometimes impossible, and, rather than lose valuable time in awaiting further symptoms, the meninges should be punctured and the fluid examined. Only in that way can we be sure of saving the child without damage, if it is the meningococcus which is at work. But, even in poliomyelitis, a lumbar puncture is rather an advantage than otherwise, for it relieves the pressure within the cerebrospinal sac, and probably diminishes congestion of inflamed structures. Examination of this fluid, too, may afford information, according to Flexner, there usually being a marked lymphocytosis in monkeys, the proportions being: polynuclears 40 per cent., lymphocytes 40 per cent., large mononuclears 15 per cent., eosinophiles 5 per cent.; while the blood-count was polynuclears 60 per cent., mononuclears 25 per cent., lymphocytes 12 per cent., eosinophiles 3 per cent., occurring with a distinct leucopænia. This diminution of white corpuscles did not disappear until the acute stage of the disease subsided. It will be noted that these findings are different from those revealed by the more thorough examination in human beings by the Washington Committee. Inoculation of a monkey with cerebrospinal fluid from an abortive case may be used for diagnosis of a dangerous carrier. Vomiting is often an early symptom, and headache is the rule. Rigidity of the neck and Kernig's sign are most marked in the meningeal

[2] Ph. Roy, Washington Committee.

type of onset. In some cases the extremities are cold in spite of the general fever.

Treatment.

I. *Acute Stage.*—There are two distinct indications: 1. The first is *to preserve life and prevent paralysis.* We have no certain means of accomplishing these objects; and the students of immunity are not hopeful of making a serum either to arrest the disease or to prevent its inception. Hexamethylenamine has completely failed to arrest the inflammation in cord and meninges, although it has been thoroughly tested in the Washington epidemic this year. There is, however, a remedy of which we may hope that further trial will show the use. I refer to mercury, the power of which over some infections has become better realized since it has been employed by injection into the muscles or veins.

A Case.—I have, however, only had opportunity to test it in one case of poliomyelitis during the acute phase. It was done because of a sudden advance of acute ascending paralysis in an adult who had apparently improved on the preceding day, the fifth of his disease. By lumbar puncture also, 10 c.c. of cerebrospinal fluid were withdrawn. Headache and nausea were at once relieved, and the paralysis ceased to progress, while the temperature fell steadily. During three days, five doses were given of mercury bichloride of gr. ⅓ and ¼ alternately. In another case of the same kind with which I was associated, the remedy was not tried, and the disease progressed to respiratory paralysis and death on the fifth day. Both these cases were adults seen in consultation, the first with Dr. John Lewis, of Bethesda, Md., the second with Drs. A. B. Hooe, and Roy, of Washington. It is true that the injections would greatly perturb a child who is hyperexcitable from meningitis; but a temporary disturbance is preferable to paralysis or death, and much less pain is produced by the small needle used than by the injection-syringe needle required when diphtheria or meningococcus diseases are in question.

If the disease is protozoal, the rationale of mercury is evident; and it is possible too that some arsenical derivative may be applicable.

Many have recommended cupping and other derivatives to prevent spinal hyperæmia. The rationale of this is at least doubtful when we reflect that the hyperæmia is nature's defense against further invasion.

Special indications are: The constipation and retention of urine; which should be met by copious enemata, and not by drugs to stimulate peristalsis, which is deficient not because of local toxins, but because of interference with innervation at the center. Sometimes, a catheter is required; but usually a flow from the bladder will follow a third or fourth enema, the first indeed often failing to expel any fæces.

2. The second indication is *to minimize the pain and irritability* of the attack, and to secure rest and sleep.

The warm bath or hot pack is most efficacious in some cases. It not only acts as a revulsive to sooth the nervous system and tranquillize the circulation by its warmth, but it has the mechanical function of supporting the limbs so evenly that there is no drag to stimulate afferent nerve impulses and add to the irritation due to the meningomyelitis.

Other measures which secure the same end are water or air beds; maintenance of the limbs in a semi-flexed posture by soft pads, and support of the feet by a firm one. Support of the back by a firm cushion, well warmed and not too hard, gives great relief, and the proper adjustment of the pillows under the neck is of great importance.

An immobilizing jacket has been of great service in giving comfort to some little patients.

An icecap sometimes causes great distress, and its use has no justification except the thoughtless routine of orthodoxy.

Finally, after the inflammation has subsided,—usually in about a week,—*galvanism* should be used as a direct means of diminishing the pain which is derived from the stretching and sagging of joints, ligaments and muscles caused by the loss of tonus in the muscle groups paralyzed, sometimes aggravated by hypertonus of antagonists not paralyzed. The relief given in this way is surprising to those who have not tried it.

An adult case seen with Dr. Ammerman, of Washington, would gain a tranquil repose of over two hours after half an hour's application of galvanism to his paralyzed muscles. At other times, restlessness and pain were so great that only by morphine could he secure any sleep at all, and his day was a perpetual misery. The hot bath was unavailable at that time.

II. *Treatment of Residual Paralyses.*—Little children are reluctant to essay movements of a partially disabled limb. When it is an arm, they let it hang and use the other; if it is a leg, they make no effort and prefer to be nursed and waited upon. Suspension in water greatly facilitates movement when the muscles are feeble. We in Washington can fully confirm the experience of the New York Committee, who found out how easily the child could accomplish little movements in a bath which he was unable even to attempt when his limb was not so supported; and it is very easy for the mother or nurse to invent little play games to maintain the child's interest for an hour at a time while suspended in a warm bath. There is no danger in this so long as the water is maintained near blood-heat. The skin does not macerate, and the effect upon nutrition is most favorable. To stimulate the circulation in the limbs, they should be massaged several times a day. From this procedure one must not expect to procure regeneration of atrophied muscle and nerve. Surgeons know well that muscles supplied by a cut nerve atrophy and will not regenerate although they are massaged till doomsday.

Galvanism.—If, however, they are galvanized from the beginning, atrophy will not occur; for the exercise of their contractile functions maintains the integrity of the muscle elements, and it is only galvanism which can excite contractility when the motor nerve and its endings have degenerated. If treated by galvanism from the beginning, a living muscle cell will greet each regenerated nerve-fiber which pushes to its destination. If galvanism is not used, only the envelopes of dead muscle spindles will be met with. The time for these to regenerate must then be added to the duration of every case not treated by galvanism.

It is necessary to restate these simple physiological facts on account of the

vogue of the pernicious statement that no treatment of poliomyelitis should begin until four months have elapsed. This doctrine is another instance of unthinking orthodoxy. But, if the elementary physiological considerations just presented make no appeal, I need only cite the high authority of Erb, Bergonié, Zimmern, and Zappert, the distinguished Viennese pædiatrician (added to that of Duchenne's final experience), who makes a practice of galvanizing the paralyzed muscles just as soon as the acute symptoms subside.

Mode of Application.—The current should be applied only to those muscles which are paralyzed, and the negative pole should be placed over the muscle itself near its tendon of insertion, while the positive pole is attached to a large electrode applied over the abdomen or other indifferent point. It is useless to stimulate the motor point except during the first two weeks, *i.e.*, before nerve-endings have ceased to be stimulable on account of degeneration.

Of course, contractures and other deformities should not be permitted, and, even when paralysis is complete and irrecoverable, they can be largely prevented by the maintenance of proper posture. Orthopædics is the resort of despair and, in many cases, the result of neglect of proper and early treatment in preventing deformities; but the weak muscles may be reinforced with advantage by elastic suspenders even after a few weeks.