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REPORT OF THREE CASES.

BY

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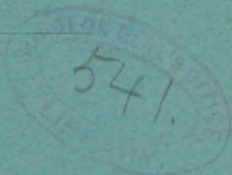
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PHYSICIAN TO THE ORTHOPEDIC HOSPITAL AND INFIRMARY FOR NERVOUS
DISEASES, AND NEUROLOGIST TO THE PHILADELPHIA HOSPITAL.

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**ON LEAD-PALSY IN CHILDREN; WITH A
REPORT OF THREE CASES.¹**

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A CAREFUL search through current literature and the text-books shows great paucity of material in regard to plumbism in young children. In an admirable and thorough article on lead-poisoning, James J. Putnam² remarks that the justification for his article "is found not in the abundance but in the meagerness of the present accumulation of facts relating to children, and the importance of taking steps toward increasing it." I have been able to find no other cases besides those which Dr. Putnam has quoted in the complete table which he has added to his paper.

Wilson, in *Pepper's System of Medicine*,³ says: "Lead-poisoning is an affection of adult life. Of 102 cases, two only occurred in individuals below twenty years of age."

D. D. Stewart, of Philadelphia, whose article on

¹ Read before the Association of American Physicians at Washington, D. C., May 31, 1894.

² *Encyclopedia of the Diseases of Children*, vol. iv, p. 615.

³ "Chronic Lead-poisoning," *System of Medicine*, vol. v, p. 686.



poisoning by buns colored with chrome-yellow attracted so much attention a few years ago, writes me that he made a thorough search through the literature of lead-poisoning when investigating these cases, and made notes of all nervous cases, especially those with brain-symptoms. He found many cases of cerebral disorders, like convulsions, which occurred in children, but none of paralysis. He also remarks that in German literature there are a number of accounts of whole families being poisoned by lead, through working and living in the potteries; but there are no records of palsies in children among these cases, though paralysees in the adults are common; and it was related that the children had headache and convulsions.

Among Stewart's cases of chronic lead-poisoning from eating the chrome-yellow buns, seventy-nine in number, there were many children. These were especially affected with convulsions, but there were no cases of wrist-drop or other palsies among them.

There is apparently no reason why children should not be as susceptible to lead-poisoning as adults. Children are as much exposed to the dangers of lead-poisoning, except in those cases which occur among workers in lead—as, for instance, painters, manufacturers of white lead, and those employed in potteries.

There are many cases on record in which children of various ages have been seriously poisoned by the absorption of lead into the system. On the other hand, in epidemics of lead-poisoning from drinking-water, the proportion of cases in children is small. In the epidemic which occurred at Tredegar, Eng-

land, reported by Dr. Brown, and quoted by Putnam, there were no serious symptoms in any person under eighteen years of age among fifty-two cases of well-marked lead-poisoning.

Putnam refers to another epidemic, in which thirty-eight persons were exposed to poisoning through drinking-water. Thirteen were affected; but no children were attacked, although there were eight among those who had been drinking the infected water. It is probable, therefore, that children are not so liable to lead-poisoning as adults; and this is no doubt due to the fact of their possessing more active powers of elimination; their greater bodily activity, and the greater energy of all of their secretions, causing the ready elimination of the lead from the system.

The sources of lead-poisoning are so numerous that it is remarkable that more cases do not occur. Drinking-water in cities, from passing through lead pipes, frequently becomes charged with lead. Lead is to be found in cooking utensils, in red rubber, which is sometimes used for making nipples for nursing-bottles, in the solder used in cans, coverings of sweetmeats, and in lead chromate, which is used in coloring toys, cloths, and other articles.

It is evident from the cases that have been recorded, in which a large number of persons have been equally exposed to the danger of lead-poisoning, that the degree of susceptibility varies, as but a small proportion of the persons exposed are attacked.

The symptoms of lead-poisoning in children which have been most frequently noted are disturb-

ances of digestion, such as colic and vomiting ; and the cerebral symptoms, indicated by headache, convulsions, and stupor. Chronic lead-poisoning is most likely to be manifested by a general loss of flesh, failure of appetite, and the earthen hue of the skin, with a jaundiced condition of the conjunctiva. In chronic lead-poisoning disorders of digestion are most common ; constipation, attacks of colic and vomiting frequently occur, and there is other evidence of derangement of the stomach in the defective assimilation that exists. In other cases symptoms of kidney-disease are present ; and it is well known that there is a form of nephritis due to accumulation of lead in the kidneys.

The symptoms dependent upon disease of the nervous system due to lead-poisoning are motor and sensory. The most common of these, of course, is paralysis of the extensor muscles of the forearms. In children, however, it is a noteworthy fact that the paralysis is as liable to affect the lower extremities as the upper. There are but few cases reported in which sensory disturbances have been met with in children. Cerebral symptoms are not uncommon in children. The lead encephalopathies in children have been frequently met with, especially, as already remarked, among the cases reported by Stewart, and Putnam refers to other cases.

The cases of lead-palsy in children which are quoted by Putnam are, first, that of a girl of eight years, reported in the *Lancet*, who suffered from paralysis of all four extremities, from the use of Sheffield drinking-water ; and a similar case which

was related by Seligmüller, who credits it to Duchenne.

H. D. Chapin¹ gives the history of two cases of lead-palsy in children. I will detail these at some length because of their curious similarity to the cases which I shall report later.

The father was a painter, and kept paint in the house, so that the children were constantly exposed to its influence. They enjoyed good health until December 25, 1882, when the room in which the children lived was painted. On January 1, 1883, one week later, F. W., aged seven years, was seized with abdominal cramps; on the next day R. W., aged five, complained of the same symptoms. The pain lasted for four weeks, and there was intense thirst. There was then pain and soreness in the legs, and the children were averse to walking. By the last of January they could not stand. They then improved somewhat, but during February another similar attack occurred. There was pain, followed by paralysis, and the loss of power lasted much longer than in the first attack. On May 3d, a third attack occurred in one boy, in which the hand was affected. The children now came under Dr. Chapin's care. They could walk with difficulty, and a blue line was observed upon the gums. They were lost sight of for a year, when they were examined again by Dr. Chapin. They were then worse than they had been before; they were utterly unable to walk, and pains throughout the body were complained of. The teeth were loose, the gums were spongy, and there was headache. The muscles did not respond to faradism or galvanism, but sensation

¹ Medical Record, New York, 1884, p. 546.

was normal. The house in which they lived had been cleared of paint a year previous, and there was nothing to account for the repeated attacks.

The children were admitted to the hospital, and after treatment they improved greatly and were able to walk somewhat. An examination of the urine showed the presence of lead. There was partial paralysis of the anterior leg-muscles, and these showed the reaction of degeneration.

Dr. Chapin called attention to the striking resemblance of these cases to spinal paralysis of infancy. This writer also related the case of a child, two and a half years of age, in which a solution of lead acetate was applied to a splinter-wound. In four days both legs were paralyzed, but the child soon got quite well. This is, I think, rather a doubtful case of lead-paralysis.

The sixth case is reported by Putnam, from the records of the Children's Hospital, Boston, in which a girl of six years, after having been exposed to a freshly-painted house, had attacks of vomiting, which affected her at intervals for two weeks, followed by weakness of the legs, toe-drop, and waddling gait. A month later there was weakness of the fingers and the wrist; the extensor muscles were affected in both arms and legs, and the knee-jerks were absent. Two months later the paralysis had disappeared, but the legs were easily fatigued.

A seventh case has been reported by Miller,¹ in which a child of four years was poisoned by drinking-water; but it is merely observed that there was a paralytic state.

¹ New Orleans Medical and Surgical Journal, 1873, vol. i, p. 198.

A case is reported by Letheby, in which a child of six years took lead acetate in doses of one-fifteenth of a grain two or three times a day for nine weeks. There was loss of flesh, colic, paralysis of the limbs, convulsions and coma, followed by death, which occurred two days after withdrawal of the medicine.

These constitute all the cases of lead-palsy in children that I have been able to find, except one reported by Suckling,¹ in a boy of fourteen years, who worked in zinc and lead for eighteen months, and who presented evidences of multiple neuritis, without other symptoms of lead-poisoning.

The following three cases came under my observation at the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases. The parents were healthy and had nine children. One child died of spinal meningitis at five years of age. It had from birth a large head. Another child died of convulsions at three years of age. Four other children are perfectly healthy, and the remaining three are the cases of which I shall relate the histories.

The father is a house-painter by occupation, and had his shop in the house in which he lived. The children frequently played about the room in which he kept his paints, and often got the paint on their hands and faces, and sometimes were seen to put it in their mouths.

CASE I.—Sarah McD., aged ten years and six months.

¹ British Medical Journal, 1888, vol. i, p. 649.

Previous history. Her health had always been good previous to the onset of the present trouble. She cut her teeth and walked at an early age, and never had any intestinal disorders.

She was brought for treatment to the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases, in July, 1889. About one month previously, she awoke in the morning with partial loss of power in the legs. She had fever of short duration, and there was constipation and some vomiting, but no colic. The weakness of the legs steadily increased, and pain in the legs was complained of. Four weeks later the arms became weak, and there was gradual wasting of all the limbs. The weakness and atrophy were most marked on the right side.

The child was treated as an out-patient by means of electricity, and in October, 1889, she had almost completely recovered the use of her legs. In June, 1890, she grew gradually weak for about a week. She then lost the power of standing, and could not use her arms. In this attack there was fever, vomiting, and constipation, but no colic. There were no convulsions, no coma, and no headache. On July 14, 1890, she was admitted to the hospital. Her condition was then as follows :

There was loss of power in all of the muscles of the legs, more or less complete ; and there was complete wrist-drop and ankle-drop. The patient was unable to use the hands or arms, except that she could slightly move the arms at the shoulders. There was great muscular wasting, but no changes in sensibility. The patient's mind was clear, and her general health was good.

The electric examination showed absence of response to the faradic current in the extensors of the legs, thighs, and forearms, and diminished reaction in the flexors to galvanism.

The reactions to the galvanic current were as follows :

Right tibialis anticus and common extensors	R D
Right peronei	K cl > A cl.
Left tibialis anticus and common extensors	K cl = A cl.
Left peronei	K cl > A cl.
Left forearm-extensors	R D
Right forearm-extensors	K cl > A cl.

The patient was treated with daily faradization and massage, and in about four months she was able to walk about and to use the arms freely. She was discharged greatly improved, November 8, 1890.

She was examined on May 17, 1894, and her condition was as follows :

Both feet are flat, and foot-drop is marked on both sides, when sitting. The left great toe is abducted, and all of the toes of the right foot are abducted, the great toe especially. This toe is also rotated to an angle of about 90° , so that its dorsal surface points laterally. The patient is unable to flex the feet. The left leg is a little smaller than the right. There is no wasting in the arms, and the muscular power in both is good. In walking, there is a tendency to walk on the toes, on account of a slight contraction of the tendo Achillis. The patient's general health is good, and the gums are free from discoloration or disease.

The eyes were examined by Dr. A. G. Thomson, who made the following report :

The pupils are equal, and react normally to light ; the discs are a trifle red ; the outlines of the discs are well marked ; there is no lesion of the fundus ; the muscular balance is good ; the form and color fields are normal. V. = 20/20 with both eyes.

CASE II.—Harry McD., a brother of the preceding patient, was admitted to the hospital July 11, 1892. He was six years of age, was born normally, and was breast-fed. He began to cut teeth at the

age of three months. He was healthy until the sixth month, when he had convulsions, which lasted three days. The spasms were general, but there was no subsequent paralysis. When sixteen months old he had enterocolitis. He began to walk at fifteen months of age. This child also had access to the room in which his father's paints were kept, and was frequently besmeared with paint. In November, 1891, he had an attack of fever accompanied by vomiting, loss of appetite, colic, and constipation. This attack lasted for about three weeks, when it was noticed that the legs and arms were weak. The arms could not be raised above the head, and the hands dropped at the wrists. There was loss of power in the legs, so that the child was unable to walk. Complaint of pain in the knees was frequently made. The legs and arms grew steadily thinner, and the muscular weakness increased.

On admission the child was pallid and thin. He possessed normal intelligence; his digestion, appetite, and bowels were in good condition. He was unable to stand, or to walk, and there was but little power in the muscles of the legs. The feet were in a position of ankle-drop, and attempts to flex the feet were futile. The arms could be moved slightly at the shoulders, but the power in the muscles of the arms and forearms was almost absent. There was complete wrist-drop. There was no facial paralysis.

Atrophy. There was marked wasting in the muscles of both arms and legs. There was no response to the faradic current; and there was great quantitative change in the extensors of the thighs, arms and forearms, to galvanism. R. D. was present in the extensors of the left leg, and in the extensors of the right leg. The knee-jerks were absent, and the arm-jerks were decreased.

The patient was treated with massage and electricity, and steady improvement took place; so that in five months he was able to walk about unassisted, but the toes were dragged and the feet flapped in walking. The patient had gained flesh, and the color was good.

March 27, 1894. The condition of the boy was noted as follows: He walks with the feet far apart and the toes inverted. The left leg is much weaker than the right. The circumference of the right thigh is eight inches, of the left thigh eight and a quarter inches; that of the right calf is six and a quarter inches, of the left seven inches. The knee-jerk is absent on both sides, and there is no reinforcement. There is left foot-drop, and the muscles of the leg of this side are markedly wasted. The left hand is weak, and there is atrophy of the thenar and hypothenar muscles. The elbow-jerks can be elicited.

The electric examination shows good response in the peroneal and calf muscles. The flexors of the thighs respond readily. R. D. is found in the tibialis anticus and extensor communis of both legs. The eyes show nothing abnormal.

CASE III.—Eddie McD., aged three years, a brother of the two previous patients, was admitted to the hospital July 11, 1892. He had always been healthy up to the present trouble. He began to walk at about the age of two years, but only with assistance. It was then noticed for the first time that the right leg was weak and that the foot was dragged in walking. He complained of some pain in the right knee at the same time. The leg continued to grow smaller until his admission to the hospital.

On admission, it was found that both legs were weak and that there was complete wrist-drop. The extensors of the hands seemed to be the only muscles which were affected, as the arms could be moved in

all directions. The electric examination showed reaction of degeneration in the muscles of both legs. The knee-jerks were absent on both sides. This patient also improved under the use of massage and electricity, and in five months he began to walk unassisted, but dragged the toes on both sides, more especially on the right side. The knee-jerks had returned and were slightly exaggerated.

March 27, 1894. The patient looks strong and ruddy. He runs about with freedom, but drags the right foot, and when lying down there is right foot-drop. The leg is wasted and there is inability to flex the foot. The thighs are each ten inches in circumference; the right calf is seven inches, and the left seven and a half inches. Sensation is perfect, and there are no trophic changes. The left hand is somewhat weaker than the right. The right knee-jerk is grossly exaggerated, but there is no ankle-clonus. The knee-jerk on the left is slightly exaggerated. The electric examination shows normal reactions in all of the muscles of the left leg and of the right calf. In the extensors of the right foot there is loss to the faradic current and reaction of degeneration.

In neither of these children was any blue line on the gums observed, or any diseased condition of the teeth or gums. The digestive organs were in fairly good condition on admission to the hospital, and although the children were thin and pallid, there was no distinct saturnine cachexia noticeable.

When the two boys were first admitted, an attempt was made to examine the urine for lead, but this was not successful. They were readmitted in March, 1894, and after potassium iodid had been administered for several days, the urine was

collected, evaporated, and carefully tested for lead on three different occasions; but no trace of lead could be recovered. The investigation was made in a careful and thorough manner by Dr. J. E. Talley, the resident physician.

The significance of the presence of lead in the urine in small quantities is not great, when we consider the statement of Putnam, in the article already referred to, that Drs. Comey and Worcester had analyzed for him the urine of more than 150 persons living mainly in the neighborhood of Boston, and not presenting symptoms of lead-poisoning, and found traces of lead in about 25 per cent. of them. Dr. J. Dickson Mann¹ gives as the result of a careful study of two cases these conclusions: "That lead is slowly and more or less continuously eliminated by the bowels, and, *to a very much less extent*, by the kidneys; that when once deposited in the tissues it exists as a stable compound, over which drugs have little, if any power." He also asserts that potassium iodid has absolutely no power as an eliminant of lead, although he admits that it may be beneficial in some other way in cases of chronic lead-poisoning.

In the cases that I have related, the symptoms presented were those of poliomyelitis; indeed, when Sarah McD., the eldest child, first presented herself at the Infirmary, I believed the case was one of that disease; and when she returned a year later with a relapse, I regarded it as a remarkable instance of a second attack of infantile spinal paralysis. It was not until the second child was brought to me for

¹ British Med. Journ., February 25, 1893.

treatment that I suspected some common cause for the disease, and thought that it might be one of those instances of epidemic poliomyelitis due to microbic infection.

On inquiring into the history of the children I found that their father was a painter, but the mother strenuously denied that they had been exposed to contact with the paints. When the third case was brought to me I asked my friend, Dr. J. H. Rhein, to visit the home of the children; and he discovered the fact that there was a great deal of white lead lying about, and that the children had frequently played in the paint-room, and were often daubed with paint.

The resemblance of lead-palsy in children to poliomyelitis has been noted by several writers; and it seems possible that some of the cases that have been recorded as instances of poliomyelitis may have been due to chronic lead-poisoning.

The pathology of lead-poisoning in children is generally considered as consisting in changes in the peripheral nerves; and these alterations are very closely allied to those met with in the ordinary forms of multiple neuritis. There is good reason to believe, however, that in many cases of typical lead-paralysis the symptoms are due primarily to the direct action of the lead upon the muscles. It is also probable, and this is also suggested by Putnam, that chronic lead-poisoning may produce typical changes in the anterior horns of the spinal cord, and thus give rise to a poliomyelitis, identical in its symptoms with the acute, or, so to speak, idiopathic form of the disease.

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