ACUTE SUPPURATIVE ARTHRITIS OF CHILDREN.*

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I wish to call attention to the acute inflammation of joints, variously described under the titles "Acute Suppurative Arthritis of Infants," "Epiphysitis" and "Acute Ostitis of Growing Bone." I chose this subject because these cases are not generally understood, and many joints and lives are sacrificed on the altar of our ignorance.

These inflammations occur, as a rule, either as complications or sequels of other diseases, and may begin either as a synovitis, an epiphysitis, or an osteomyelitis. The majority of cases begin as an osteomyelitis. When accompanying the exanthemata, diphtheria or typhoid, they are usually due to a streptococcus infection. Cases complicating pneumonia have been reported in which the diplococcus was the cause. The joints most commonly affected, in the order of their frequency, are the hip, knee, shoulder and elbow.

In the synovial variety the symptoms are as a rule comparatively mild. There is local heat, swelling and tenderness, with a temperature of from 101 to 102 F. When the joint is quiet, the pain may not be severe, but the slightest motion will cause severe pain. When it occurs as a complication of some fever, the diagnosis is comparatively easy, but when it comes as a sequel or without known cause, it may be difficult. In the latter instance the febrile condition accompanying the joint inflammation is frequently mistaken for an essential fever.

When a decided rise of temperature or a sudden attack of pain occurs in a child suffering from, or recently recovered from, any of the above-mentioned diseases, all of its joints should be carefully examined. This precaution is especially indicated when the child is too young to call attention to the seat of its pain.

The most common error in this as in all other joint inflammations is to make a diagnosis of rheumatism. The latter does not remain in any one joint to the exclusion of others for any length of time, and it is not a suppurative affection.

Suppurative synovitis as a complication or sequel may be polyarticular. I have at the present time a patient who had suppuration of one elbow and of the sacro-iliac synchondrosis, as a sequel of typhoid, but it is not to this very grave form of disease, formerly known as pyemia, that I wish to call attention.

Suppurative arthritis may be confounded with the bone affection of infantile scorbutus, but in the latter careful examination will demonstrate that the soreness is in the shaft of the bone. When in doubt as to the character of the contents of a swollen joint, one should draw off a small amount with an aseptic hypodermic needle. When this disease is recognized and promptly treated, the prognosis is good, but when neglected, the joint surfaces are destroyed and the patient's life endangered. When the diagnosis is thoroughly established, the only treatment to be considered is free incision and drainage. The following is a typical case of suppurative synovitis:

In January, 1895, Dr. Disen, of Minneapolis, referred to me a child 4 years old, who had recently recovered from an attack of measles, and was then suffering from an acute inflammation of the left knee-joint. The child was suffering some pain constantly and very great pain

on motion. The swelling extended up and down beyond the limits of the joint, but was most marked at the joint. This diffuse swelling is quite characteristic of the streptococcus infection. There was marked local tenderness and a temperature of 102 F. The color over most of the limb was normal, but at a point on each side of the patella there was a dull, red spot. The joint was flexed and the patient kept the limb with its outer side resting on a pillow.

The only difficulty was to differentiate between a suppurative synovitis and an osteomyelitis. I based my diagnosis of synovitis on the facts that the beginning was rather subacute, the temperature comparatively low, and that the swelling began in the joint as soon as the child complained.

A free incision was made on each side of the patella and rubber drainage-tubes were introduced, and notwithstanding the fact that the joint seemed completely disorganized, the child made a prompt recovery, with perfect motion in the joint.

The openings in these cases should always be free. It is a mistake to fill them with gauze without drainage-tubes, because gauze will not drain pus. It is always wise to explore these joints with a finger, for fear the original trouble may have been an osteomyelitis, as in that case more operating would be necessary. Irrigation with a warm normal salt solution is the best means of cleansing the joint. The dressing should be a large moist one, and should be changed frequently.

Prominent writers on joint diseases, as Macnamara and Howard Marsh, whose writings were published in the eighties, gave extended descriptions of epiphysitis as a disease of frequent occurrence in childhood. More recent writers, however, have demonstrated that while occasional undisputed cases of acute epiphysitis or epiphyseal osteomyelitis do occur, the vast majority of these cases are osteomyelitis beginning in the diaphysis just outside of the epiphyseal line. In these young patients the epiphyseal cartilage is very tender and may easily be perforated, but in the hip, the capsule of the joint extends beyond the cartilage, so that a perforation of the diaphysis close to the cartilage allows the escape of pus into the joint. When the disease does begin in the epiphysis it extends quickly to the joint, so that the joint symptoms soon overshadow the bone symptoms. It is well to remember, in this connection, that it is quite possible to have a sympathetic, catarrhal inflammation of a joint accompanying an osteomyelitis of the shaft, for what would be the only proper treatment for a suppurating joint would in this instance be a grave mistake.

Of these inflammations beginning as an osteomyelitis there are two well-marked varieties; one in which the symptoms are comparatively mild and which under proper treatment makes a complete recovery; and another in which the symptoms are those of an acute osteomyelitis with added acute joint symptoms, which, unless promptly and vigorously treated, results in more or less permanent injury to the joint. The latter variety may cause ankylosis, or there may be shortening and loose-jointedness from separation of the epiphysis. Between these two extremes are many grades of the disease, so that it is not always easy to classify a given case; my personal experience, however, teaches me that the prognosis after a timely operation is better than the findings would seem to justify.

In the mild variety the pain is not very severe, the temperature is not very high and the progress of the disease is comparatively slow. Swelling comes on grad-

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ually, and the little patient refuses to use the joint. There is local heat and tenderness. The patient loses appetite and flesh. This type occurs most frequently in the hip-joint, and is unaccompanied by redness. The skin is white and the blue veins may become quite prominent. I have found it sometimes difficult or impossible to differentiate this disease from a rapidly growing sarcoma, until I had used the exploring syringe. This disease has very commonly been mistaken for tuberculosis, and has sometimes been pronounced typhoid. The prognosis in this class of cases is good when the disease is recognized and promptly treated, but when neglected, the joint is destroyed and there is more or less destruction of bone, which may cause shortening. The only treatment is free incision and drainage. The following is a typical case of the kind:

May 2, 1898, I was called by Dr. Benjamin of Minneapolis, to see H., aged 15 months, who at that time was comparatively free from pain when quiet, but suffered greatly when the left thigh was moved. The thigh was slightly flexed, was white and swollen, with enlarged veins over the surface. There was local heat and tenderness. The child was pale and emaciated, and lay perfectly quiet, making no effort to move the limb. At this time the temperature was about 100 F. The history given by the Doctor was that the child had been perfectly healthy until March 29, when he was called and found it with a temperature of 103 F., and a tympanitic abdomen. It was crying from pain which was seemingly in the abdomen. The temperature soon dropped to about 100 F. The child lay quiet but suffered when moved. Between two and three weeks after he was called, the left thigh was found to be flexed and somewhat swollen. The symptoms continued about the same until May 2, when I was called. We made a diagnosis of suppurative arthritis of the hip, but the thigh so closely resembled a rapidly growing sarcoma that it was deemed wise to use an exploring needle, which confirmed our diagnosis.

On May 14 the joint was opened and a large amount of pus evacuated. A drainage-tube was introduced and the child began to improve at once, and in six weeks was perfectly well. Examination on Dec 19, 1898, proved the child to be perfectly well, with free movement of the joint and no shortening. We have no knowledge as to the cause of the inflammation in this case.

The second variety begins as an osteomyelitis and quickly extends to the joint. The onset is usually quite sudden. There is often a chill and sometimes repeated ones followed by a temperature of 103 or 104 F. The pain is usually very severe and the whole limb is helpless. There is local heat, and tenderness and swelling soon follow, although this is not one of the early symptoms.

When the disease is in the hip, the swelling is not marked, and in a fleshy child may not be noticeable. At an early age, when the disease begins near any joint but the hip, local tenderness and sometimes swelling can be made out near but not in the joint. When it begins near the hip-joint this is not practical, owing to the distance from the surfaces, of the parts involved.

Those of us who have been in the profession for fifteen years or more were taught that these were cases of acute suppurative periostitis, and the result was that our methods of treatment were incomplete and disappointing. We know now that primary suppurative periostitis is very rare, if it ever exists, and we also know

that the stripping of periosteum from a portion of the bone does not cause necrosis, but that necrosis is due to an inflammation beginning in the bone marrow, and that this inflammation is always suppurative.

We all understand the necessity of early diagnosis in all cases of osteomyelitis in order that we may promptly make an opening into the medullary cavity and thus stop the ravages of the disease, but the practical point I wish to make is that in infants and young children there is, owing to the anatomic peculiarities already mentioned, the added danger of an early invasion of the neighboring joint. By timely diagnosis and heroic treatment this joint invasion may be prevented. In all joints save the hip, the diagnosis and treatment are comparatively easy, but in the hip both diagnosis and treatment are more difficult.

When the disease is located in the lower end of the femur, there should be an early diagnosis and an opening promptly made into the center of the bone. I have never been content with drill-holes, but have always cut a window in the bone shaft, and have never had occasion to regret it. When the disease is located in the upper end of the femur, Macnamara has recommended and practiced drilling out the center of the neck through the trochanter, and reports some satisfactory results. I have never been fortunate enough to see one of these hip cases until after the joint has been involved, and have therefore had no occasion to resort to the drill, but have laid the joint wide open. I know of no instance in which free incision and drainage are followed by more satisfactory results than in these cases. Under this heroic treatment joints can be saved that are seemingly completely destroyed.

I have found that the easiest way to enter a hip-joint is from the front, through the opening recommended by Bradford in the operation for congenital dislocation of the hip. Theoretically this route is objectionable, because the pus must flow upward to get out, but practically it is perfectly satisfactory.

When called to one of these cases in which there is evidently an osteomyelitis, and in which there is also swelling of the joint, the surgeon should first aspirate the joint to ascertain whether there is a simple sympathetic or a suppurative synovitis. If serum is found in the joint, it will only be necessary to operate on the bone. If, however, pus is found in the joint, it must be opened and drained at the same time that the bone is operated on.

In the hip-joint, when the exact seat of the disease in the bone can not be located, it is usually quite safe to drain the joint, depending on the bone to drain itself through the joint. Unfortunately in these cases the epiphysis is often found separated.

I have met with several cases in which there had evidently been an acute suppurative inflammation of the hip-joint, which had opened itself, resulting in some cases in complete cure, while in others the sinuses remained open on account of necrosed bone or a separated epiphysis.

The following will illustrate this class of cases. A boy, 7 years old, was brought from the country to Asbury Hospital, Minneapolis, and was referred to me by Dr. Eitel. He was walking on crutches and was believed, by the friends and doctors at home, to be suffering from tuberculosis of the hip. The thigh was flexed and on motion crepitus could be detected. He was quite spare and in evident poor health, but there was no atrophy of the thigh. We learned that about six months before he came to the hospital he was taken

suddenly with severe pain in the hip and high fever, which at first were thought to be due to rheumatism and later to hip-joint disease. He continued with more or less fever and pain until he came to the city. I made a diagnosis of non-tubercular inflammation of the hip with separation of the epiphysis, and advised operation, which was readily accepted by the parents. On opening the joint I found the epiphysis separated and acting as a foreign body. It was removed and the joint thoroughly cleansed out. The boy began to improve at once, and in six weeks his wound was healed and he was able to stand on the limb. In this case there was a history of a traumatism, but it was not altogether satisfactory, so the cause may be said to be unknown.

The last case I shall report is that of baby O'Keefe, aged 16 months, a patient of Dr. Sweetser of Minneapolis, to whom I am indebted for the history.

On July 11, 1898, the child retired in perfect health, but cried the next morning when he put weight on his left leg. He crawled about that day and stood by a chair, but was too lame to walk. On this day he was examined by Dr. Sweetser, who found a normal temperature and pulse, no changed appearance of the hip, but slight flexion and tenderness. He had been walking for three weeks, had always been healthy, partly breast fed and partly on sterilized milk, and had had no intestinal trouble, no scurvy and has a good family history. He had measles the February previous, and a history of slight injury a few days before. Rest in bed was prescribed. July 16 he was worse, with some fulness about the hip and obliteration of the gluteal fold; temperature 102 F. July 17 he moved the leg with less pain; temperature 103 F. The next day the temperature was 100 F. The child was kept in bed, with an ice-bag on the hip; there was pain on motion. For the next month he continued about the same, with temperature fluctuating between 101 and 105. Toward the last he was very restless, perspired profusely and lost flesh rapidly.

On August 19, five weeks after the onset of the disease, I first saw the patient, in consultation, and we made a diagnosis of acute suppurative arthritis of the hip, and confirmed the diagnosis by removing pus with an exploring syringe. The pus was sterile under culture and contained no tubercle bacilli. The joint was drained through the anterior incision. The patient began to improve immediately, and on the third day the temperature became normal. In three weeks the wound was healed and the patient perfectly well, with motion in the joint perfect in every direction; the patient creeping, standing and making efforts to walk; no apparent shortening.

On December 15, five months after the attack and about four after the operation, I examined the child and found motion perfect in every direction, but with about half an inch shortening. While no necrosed bone could be found at the time of operation it is evident that there was either actual destruction of bone or of the growth center. If the shortening increases with the growth of the child, this will be conclusive evidence of the correctness of the latter supposition.

Traction of the Tongue in Hiccough.

This method of arresting uncontrollable hiccough, by continuous traction of the tongue for one to two minutes, has been mentioned casually before in THE JOURNAL. Noir establishes it on a scientific basis in a recent communication to the *Progress Méd.*, in which he cites observations and states that he has never known it to fail.

A PRELIMINARY INVESTIGATION OF THE THEORY OF THE INOCULATION OF MALARIAL FEVER THROUGH THE AGENCY OF MOSQUITOES.

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The inoculation theory of malarial fever through the agency of mosquitoes is not a new one. It is said to have been mentioned by Roman writers about the time of the Christian era. Linne¹ and Sir Henry Holland viewed the transmission of malarial fever through the bite of the mosquito favorably. In 1807 Crawford¹ published a paper on "the Mosquitul Origin of Malarial Fever," and King², in 1883, one on the same subject. It, however, remained for Patrick Manson to lay the foundation on which Ronald Ross has raised the superstructure of so many facts in connection with this important question. Battista Grassi probably formulated the axiom, *laddove c'è malaria ci sono zanzave*—where there is malaria, there are mosquitoes. Manson, after a long series of deductions, finally arrived at the conclusion that the mosquito acted as the intermediary host in the propagation of the malarial parasite, and published his most convincing paper on the subject in 1894. In the Goulstonian Lectures delivered in 1896 he further explained his convictions in regard to this theory. These publications of Manson influenced Ross to carry on the investigations which culminated in the present work now transpiring in various parts of the world. After Ross came Grassi, Bignami, Bastianelli, Celli, Marchiafava, and Dionisi of Italy, and later came Koch of Germany. The observations of Ross have been concurred in by Koch, Kossel, Nuttall, and Pfeiffer of Germany, by Laveran and Metchnikoff of France.

REASONS URGED AGAINST THE ACCEPTANCE OF THE THEORY.

Objections to the theory are many. One is that the entire subject is too new. Most men will probably agree that it is not the usual way in which infectious diseases are conveyed to man, and from one person to another. Again, it may be urged that the theory is against experience on this question; that only a few species of mosquitoes are capable of inoculating the disease; that observers, through their zeal, have mistaken artifacts for other than the spores of the malarial parasite; and lastly, one may ask, why should the malarial parasite choose the mosquito to act as the intermediary host in the perpetuation of its species? It is not the purpose of this paper to attempt to answer these objections. "Good reasons must perforce give place to better."

NATURAL ORDER OF MALARIAL PARASITES.

The natural order to which all recognized forms of malarial parasites belong, whether in man or birds, is to the order of *Gynosporidia*, class *Sporozoa*.

The foundation for the theory of the inoculation of malarial fever in the case of man has been built upon the experiments with bird-malaria—*Proteosoma* (Grassi), and *Halteridium* (Iabbé).

HOW THE SPORES OF PROTEOSOMA ARE SUPPOSED TO BECOME STORED UP IN THE BODY OF THE MOSQUITO.

According to the theory of Manson, the first stage necessary for the propagation of the malarial parasite in the system of the mosquito is the development of flagellated bodies, which in turn become fertilized, after which they become more motile and penetrate the stom-

1. Baltimore Observer.

2. Popular Science Monthly.