MYNTER (H.)

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ACUTE INFECTIOUS OSTEOMYELITIS AND PERIOSTITIS.[1]

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I DESIRE to call attention to one of the most serious of surgical affections, serious on account of its great mortality, its insidious and rapid onslaught, and the difficulty of its diagnosis. I refer to acute diffuse or infectious periostitis and osteomyelitis, also called acute necrosis.

It has been my fortune, or, rather, misfortune, to see four such cases, and, with your permission, I will shortly relate them, as their symptoms and progress show an unusual uniformity.

CASE 1. Male patient, æt. about 20 years, entered the Buffalo General Hospital in June, 1875, suffering from pain, swelling and rigidity of right thigh, but yet able to walk. There was a history of injury of the thigh two months previously, caused by a heavy plank falling and striking him on the thigh. He had kept his bed some weeks and been treated for muscular rheumatism. Patient had a temperature of 103°, profuse sweating, and complained of excruciating pain in right thigh. Examination of thigh for fluctuation by Dr. Gay, since deceased, gave negative result, but, nevertheless, he made a deep incision four inches long down to the bone on the outer side of the thigh. Dark venous blood, but no pus, was discharged. Examination of the bone with the finger showed it to be roughened and denuded of its periosteum. Twenty-four hours later the temperature had risen to 105°, with other symptoms pointing to pyæmia, and patient died in 72 hours from time of entrance. I myself made the post-mortem in the presence of the hospital staff. The whole femur was found

[1]Read before the Alumni Association of Niagara University.

denuded of its periosteum and was removed in toto and sawed through. It was found in a state of diffuse osteomyelitis, filled with larger and smaller abscesses, here and there gangrenous. Evidently the disease had started as an osteomyelitis and the accompanying periostitis was secondary. The incision, therefore, failed to relieve the tension and he died of pyæmia.

CASE 2. In 1881 I was called to see W. H., æt. 9 years. He had been sick in bed three days, having been slightly injured in right leg by coasting down a hill during the winter. I first learned this fact after he was dead. I found him delirious, with a temperature of 105°, a rapid and weak pulse, dry tongue, moaning but unable to give any intelligent answers. I am free to state that I did not recognize the trouble—much more so, as my attention was not called to his leg. Next day I called a consultation, but we were unable to decide upon a diagnosis, vacillating between meningitis and septicæmia of unknown cause. He died the following (fifth) day. A post-mortem was held and during that our attention was called to the right leg, the father then for the first time stating that during the first two days the boy had complained of pain in that leg. The periosteum was found completely detached from the fibula and a small amount of pus mixed with fibrinous exudations was found between the periosteum and the bone. We were not allowed to remove the fibula, so I am unable to state whether it was primarily an osteomyelitis or a periostitis.

CASE 3. On June 23, 1884, I was called in consultation by Dr. L. Schade, of this city, to see a girl, E. H., æt. 7 years. Dr. Schade was called in on June 21; found the child delirious, with high temperature, dry tongue, rapid pulse and complaining of severe pain in left femur. He ordered hot applications and antifebril treatment. The child rapidly grew worse. At the consultation on June 23 the child was found almost in a state of collapse, with left leg strongly flexed in hip and knee and with all the usual symptoms of acute pyæmia except metastatic abscesses. A diffuse fluctuating swelling was felt over the whole femur, while the skin looked normal. I made several incisions down to the bone and a great deal of matter was evacuated. The whole diaphysis of the femur was found denuded of its periosteum and roughened. The child died next day (fourth day); no post-mortem was allowed.

After these three fatal cases, it is with great satisfaction that I report the following case, treated successfully by early operative interference, and I have no doubt that it would have terminated fatally by any other treatment in a very few days.

CASE 4. R. K., æt. 9 years, only child of wealthy parents, was taken sick December 24, 1888. He is a strong, healthy boy, who has never been sick except 7 years ago, when he had a severe scarlet fever. The parents are healthy and no scrofula has existed in the family. He had been playing, dressed in rubber boots, in the sloppy snow the whole day. He came in toward evening and complained of severe pain in right ankle and of feeling bad. The pain increased steadily and I was called about 11 P. M. I found him restless and fretful, feverish (temp. 101°). No swelling was discovered, but the right ankle-joint was perfectly rigid and could not be moved without intense pain. The parents believed him to have inflammatory rheumatism, and to satisfy them I ordered salicylate of soda in 5 gr. doses every two hours and a lead and opium wash.

December 25. He was restless and feverish the whole night. The rigidity of the ankle joint had disappeared on my morning visit, but he complained now of intense pain over malleolus externus. There was no redness seen, perhaps a little puffiness. The boy was evidently in great pain, had an anxious, flushed expression, a temperature of 102° and a pulse of 108. The tenderness was so great that no manual examination could be made.

I applied 3 leeches over malleolus externus and continued thereafter the opium and lead wash. The leeches bled freely and relieved the intense pain and toward evening he felt more comfortable, was less feverish (temperature 101°), but still tender on pressure.

December 26. Was restless during the night and did not sleep at all in spite of morphia. Temperature 105°, pulse 126. He is much worse, is slightly delirious with dry, brownish tongue and painful, anxious expression; intense tenderness along the whole right fibula with indistinct swelling, puffiness, and loss of contour of limb; no redness of skin, some venous engorgement. He complains of a severe pain on deep inspiration in left side, and pain in right shoulder joint, which is rigid. Respiration less distinct over left lung.

At this time, 36 hours after my first visit, I had no doubt of the serious nature of the disease, and told the parents that the child would die in a couple of days unless immediately operated. I had already the day before prepared them for this emergency.

Under chloroform-narcosis, Drs. Park and Cook being present, I first made an incision over the upper third of the fibula, where the swelling seemed most distinct, down to the bone. The muscles were found in a state of œdematous infiltration, but the bone seemed healthy and no pus was found.

An incision was thereafter made over malleolus externus and lower third of the fibula, and about a teaspoonful of dark colored pus mixed with fibrinous exudations, was discharged. The whole fibula was found denuded of its periosteum and a probe could be introduced under the periosteum to the upper incision. The intervening bridge was therefore cut through and the whole fibula laid bare and found denuded in its whole length. The periosteum was thickened, reddish, and covered with fibrinous exudations. The wound was syringed out with corrosive sublimate (1-1000), filled with iodoform-gauze and an antiseptic sublimate dressing applied.

At my evening visit, 8 hours later, temperature was 100°, pulse 96, and the patient resting easily without pain.

December 27. Perfect relief from pain, both in leg, shoulder and pleura. Temperature normal.

December 30. Bandage changed. Fibula shows a diffuse reddish tint; wound and periosteum began to granulate.

January 4, 1889. Second change of bandage; healthy granulations.

January 11. Bone covered with granulations.

January 26. Wound almost superficial and rapidly cicatrizing.

February 12. Wound almost healed except over malleolus exit, where there is a small fistula, leading down to denuded bone.

February 18. The fistula was dilated and a small sequestrum, $^1/_8$ inch long, was extracted. He has no pain or tenderness, can walk without limping, perfectly free movement of the ankle joint.

February 26. Perfect recovery: patient discharged.

This case is of interest in showing that the disease may begin as an acute periostitis, to be followed probably very early by an acute osteomyelitis, and that an early operation may result in perfect *restitutio ad integrum.*

These four cases include what I myself have observed of this disease, but I desire to add a few other cases, which have occurred in the practice of colleagues in Buffalo, and which are well authenticated.

CASE 5. W. S. B., a boy, æt. 8 years, had always enjoyed good health, but was perhaps less vigorous than other children. He was the nephew of a well-known surgeon, Dr. E. Barnes, at that time confined to his bed with fracture of the femur, and lived in his house. He had slight symptoms of rickets. On May 17, 1878, he was at-

tacked with a panaritium of right great toe, which after some days was lanced, and then occasioned no further trouble.

May 21. The boy felt a little out of sorts and had slight chills, for which simple remedies were employed.

May 22. A severe chill occurred, followed by severe pain in left knee, ankle and tibia, particularly upper end near tuberositas tibiæ. The patient was able to step on the leg. Temperature 102°, pulse 120. Dr. Barnes had him brought to his bed, but could discover no redness or swelling, lymphangitis, phlebitis or enlarged veins. Movements of the joints were not painful, but the anxious and pale suffering expression indicated a serious illness. By aid of anodynes he slept some during the night, but was else restless with exacerbations and remissions of pain.

May 23. On account of Dr. Barnes' fracture Dr. Folwell took charge of the case, and I quote henceforth from his full and voluminous notes of the case. At his morning visit the little patient was found drowsy from anodynes, but else replying intelligently to questions. Tongue heavily coated, temperature 103°, pulse 132, great apathy and absolute loss of appetite. Paroxysmal severe pain in left leg referred to tibia, but not to any particular spot, greatly increased by pressure and movements. There was little if any swelling of the leg Recognizing the extreme gravity of the disease, but else unable to locate the cause of the apparent state of septicæmia, Dr. Folwell called Dr. Boardman in consultation, who thought it a case of phlebitis. The treatment so far had consisted of anodynes, soothing applications, stimulating diet and quinine and sulphuric acid, "a diagnosis," as Dr. Folwell states, "not being necessary as far as treatment was concerned." At the evening visit temperature was 103°, pulse 140, considerable delirium and hurried breathing. The limb was now swollen from knee to ankle, the veins tinged and dark-colored on a large part of the inner surface of the leg.

May 24. Patient wakeful, restless and delirious during the night. Temperature 102°, pulse 180, irregular, rapid breathing, tongue brown and dry, skin clammy and cool, cold extremities, leg and thigh largely swollen, venous congestion very marked and patient collapsing from blood-poisoning.

Giving a fatal prognosis Dr. Folwell called in Dr. Burwell and the late Dr. J. F. Miner, than whom no more experienced and careful surgeon existed. They confirmed the prognosis and the diagnosis as far as the septicæmia was concerned, but did not discover the local cause, Dr. Miner stating that he had never seen a case "like it before and

did not know what it was." The patient died at noon same day, after an illness of less than four days.

A post-mortem was held, all the gentlemen interested being present. The femoral vessels were found unobstructed; some swelling of inguinal glands. The leg was split open, but no disease of the soft tissues was found. The periosteum adhered normally to the bone and appeared healthy in front, but on the sides and behind, it separated easily, was spotwise injected and thickened and three inches below the tuberositas tibiæ on the posterior surface one ounce of pus was found between the bone and the periosteum. The bone was split and showed unmistakable signs of osteomyelitis, increasing in intensity toward the upper end of the bone. Dr. Folwell closes his careful report with a short summary, in which he states, and I perfectly agree with him, that osteomyelitis ought to have been diagnosticated,

1. On account of the intense pain and absence of any appearance of disease in soft parts.

2. On account of the rarity of phlebitis in childhood.

3. Because a periostitis would have given a more speedy swelling of the soft parts, and

4. On account of the profound constitutional disturbances with absence of local symptoms in the beginning, save the extreme pain. I have quoted from Dr. Folwell's report at some length, because this case shows better than any I have come across, the insidious attack, the rapid progress and the difficulty of diagnosis of acute necrosis, when it commences as a diffuse osteomyelitis. It also shows its great rarity, when even such a surgeon as the late Dr. Miner could be in doubt as to what was the matter, and state that he never saw such a case before. On the other hand, it must not be forgotten that our knowledge of the pathology and consequently of the treatment of this disease has been greatly increased in the last few years by the discovery of its bacterial origin.

I will add a short report of one more case, observed by my friend Dr. Charles Cary, and published in New York *Medical Record*, 1878.

CASE 6. He was called on October, 1878, to see a girl, æt. 7 years, of healthy parentage. She had been around, but somewhat ailing, for five days. She now complained of pain in legs and hip joints, was delirious, with anxious countenance. Temperature 103°, pulse 120. The legs were swollen and œdematous. The pain had commenced n

left ankle, but invaded the right ankle too inside of twenty-four hours, and both joints were red, swollen and presented the appearance of acute rheumatism. The child died two days after under typhoid symptoms, no certain diagnosis having been made, although osteomyelitis had been suspected. A post-mortem was held, imperfect on account of the parents' objections, and only one tibia examined. It was found denuded of its periosteum and a great deal of pus found between the bone and periosteum. The other tibia and the thighs were supposed to be in the same condition. The case is of interest, partly in showing that the affection may be multiple, partly on account of its similarity to inflammatory rheumatism.

I might still mention other cases which have come under my notice by talking with colleagues in Buffalo. They occurred in children without any known cause, and terminated fatally in a few days. No case here is known to have recovered except my case (No. 4), which was early diagnosticated and operated.

It is only during the last five years that the bacterial origin of this disease has been definitely proved. Earlier writers, as Lücke, Kocher and Rosenbach, recognized it as an infectious disease, but the cause was first discovered by Becker, who in 1883 published a paper in the *Deutsche Med. Wochenschrift*, (ix, p. 46) on the micro-organisms producing acute infectious osteomyelitis. He succeeded in isolating and culturing the micrococci. Inoculations of larger amount produced septic fever and diffuse suppurations, but no osteomyelitis, unless a bone was contused or fractured a couple of days before.

His experiments have been verified by a number of later writers. Rosenbach mentions in 1884 that in 15 cases of osteomyelitis he found staphylococcus pyogenes aureus, the yellow staphylococcus 14 times, one time besides staphylococcus albus and one time streptococcus.

In one typical case streptococcus was found alone.

He considers the coccus of osteomyelitis and of common suppuration identical, and has produced osteomyelitis by inoculation with the staphylococcus from a furuncle of the lip. Kraske (*Centralblatt f. Chirurgie*, 1886) found by examining fresh cases of osteomyelitis staphylococcus pyogenes aureus

always present, but frequently also other forms, as staphylococcus albus, streptococcus and bacilli. His conclusions are, that staphylococcus pyogenes aureus is able to produce acute osteomyelitis, and most frequently is the only cause, but that often other forms, as staphylococcus albus, streptococcus and bacilli are found, and that these cases of "mixed infection" are the most severe, and their presence therefore of interest in regard to prognosis.

He considers it probable that every micrococcus which has a pyogenic character may produce osteomyelitis, which therefore cannot be considered a specific infectious disease, as it is not produced by a single specific germ but by many, and as the germ most frequently found may produce by inoculation other diseases and is constantly found in suppurations, abscesses, empyema, phlegmons, furuncle and carbuncle. Garre has conclusively shown that the staphylococcus pyogenes aureus of osteomyelitis is identical with that of other inflammatory diseases. He cultured the staphylococcus pyogenes aureus of osteomyelitis through three generations and rubbed it into his left, well-disinfected, arm. The result was a regular carbuncle. The experiment is of interest also in showing one way through which infection may occur—the skin. Kraske mentions one case of fatal osteomyelitis, in which infection took place from a furuncle on the lip. It complements Garre's case in proving the identity. He considers it doubtful if the germs can be absorbed from the intestinal canal, but mentions one case which seems to show that they may enter through the respiratory organs. It was a fatal case of osteomyelitis following pneumonia, and he was able to demonstrate staphylococcus pyogenes aureus in the lung and bronchial glands. Fränkel has shown that staphylococcus pyogenes aureus is found not only in angina faucium, but constantly also in the healthy pharynx. If always present, some disposition as yet unknown must be present to produce the disease. Why it particularly occurs in youth is also unknown. Possibly the acute infectious diseases which most frequently occur in childhood, increase the disposition for an attack of osteomyelitis, such as typhus, scarlatina, measles, variola and vaccination. Ponfick has demonstrated that typhus is followed by certain

changes in the medulla of the bones, which may favor the growth of the cocci.

In regard to symptoms very little needs to be added. The symptoms are simply those of acute pyæmia with metastases complicated with the local inflammatory symptoms. The pain is excruciating with exacerbations at night, increased by pressure, if the periosteum is the starting point, by tapping and then deep-seated, if it commences as an osteomyelitis. Delirium and sopor occur early and may mask the local symptoms, so that the local cause is not discovered. The periosteum is a barrier long impassable for the inflammation, hence the strangulation and the total necrosis of the diaphyses, if the patient lives long enough and early operation is neglected.

The epiphyses generally escape the necrosis on account of their special blood supply. If the inflammation commences as an osteomyelitis, the result is the same, possibly a little faster. The Haversian canals cannot dilate quickly enough to accommodate the swelling, and strangulation of the soft tissue occurs by pressure of inflammatory products. The periosteum then suffers secondarily. Subperiosteal abscess does therefore not indicate that the periosteum was primarily attacked; it may be the last place of an osteomyelitis. In some cases the deep pain is accompanied with slight hydarthrosis of the adjoining joints before the swelling appears. The general symptoms often precede the local symptoms, although not usually. If oil globules are present in the pus, due to transudation of medullary oil through the Haversian canals on account of increased intraosseous pressure and rupture of fat-vesicles, osteomyelitis is present. This symptom is of importance in regard to treatment. A common result is separation of the epiphyses and severe joint affections, if the patient lives long enough. The disease may have a very rapid progress. Prof. Kohts reports (*Deutsche Med. Wochenscrift*, 1887) a case of osteomyelitis acutissima which terminated fatally in less than two days. The patient was a girl, æt. $3^1/_2$ years, who was attacked suddenly with high fever and intense pains in right leg without local symptoms. She died next day with symptoms of trismus and tetanus. V. Recklinghausen made a searching post-mortem exami-

nation and found a beginning osteo-myelitis, fatty emboli and miliary infarcts in the lungs, micrococci in the capillary arteries and bronchi with peribronchitis, micrococci in the capillaries of the spleen and kidneys.

Kohts draws the following conclusions: 1. That acute osteomyelitis may terminate fatally in one and a half to two days, like any other infectious disease. 2. That excessive pain in a bone without local symptoms, combined with a high infectious fever, indicates primary infectious osteomyelitis. 3. That the lungs may be the point of infection.

A speedy fatal termination has in some cases occasioned suspicion of foul play and consequently gives rise to medico-legal investigations.

Prof. Maschka (*Vierteljahrsch f. ger. Med.*, 1885,) mentions such a case. A boy, æt. 13 years, died in four days after having been slightly kicked by a playmate. Post-mortem showed osteomyelitis maligna, periostitis, pericarditis, empyema and embolic nephritis. The osteomyelitis was the primary lesion. Maschka supposes that the child was previously infected with bacteria and that the kick and jumping during play may have produced local disturbances of the circulation favorable to the development of the bacteria in the bone.

With an increased knowledge of the etiology and pathology of this disease our treatment has been radically improved and we have now scarcely in the whole range of surgery a disease more amenable to treatment or favorable in its prognosis, if prompt and energetic measures be taken, or more fatal if they be neglected. Inflammation of bone tissue may be treated like that of soft tissue. By early incision and, if necessary, trephining of the bone with removal of the inflamed marrow, we may abort the inflammation and prevent the necrosis and pyemia. The periosteum may become reattached and the vitality of the bone does not suffer by the thorough removal of the marrow, as my friend, Dr. Tscherning, of Copenhagen, has shown. In a paper read before the Royal Medical Association in Copenhagen, in 1886, published in the *Nordisk Med. Archiv.* of 1887, he recommended the immediate removal of the bony marrow in acute osteomyelitis in order to remove all the pus and inflammatory products. With hammer and

chisel he makes one or two fenestra large enough to remove the diseased marrow and drain the cavity. The first fenestrum oug t to be near the epiphyseal cartilage, where the inflammation is apt to start. With sharp spoons the whole inflamed marrow is then removed. This treatment neither endangers the life of the patient nor the vitality of the bone. He reports twelve cases treated in this way, ten of which occurred in childhood. All the patients recovered, the function of the limb was restored in all cases and the operation was in most cases performed so early that excessive destruction of the bony matter was prevented. The earlier the operation is performed, the more favorable the prognosis and the quicker the result. I was present in Copenhagen when he read his paper in 1886, and my little patient owes his life to that. In malignant cases with total denudation of the periosteum he recommends the same operation, although the prognosis is less favorable. In cases of circumscribed osteomyelitis and periostitis this treatment is without danger and the results always favorable. While Chassaignac and many surgeons with him believed that nothing but amputation could save the patient, we now know that incision, followed by trephining, if necessary, is not only curative but devoid of danger. Diagnosis established, it is impossible to operate too early. We should anticipate the suppuration, which is bound to come, instead of fighting it after it has occurred. The acute septic fever with high temperature and intense pain in a bone points to an acute osteomyelitis, and demands incision down to the bone as first measure. If the periosteum is found detached with subperiosteal effusion or suppuration, we may stop here.

If the periosteum is found healthy or only slightly œdematous, possibly with oil globules, trephining of the bone and removal of the marrow becomes necessary. If no improvement follows simple incision, the bone ought to be trephined shortly after. Total subperiosteal removal of a bone, as recommended by Ollier, when there is suppuration of a joint and large part of a diaphysis, is never necessary, even if function allows it.

Bockenheimer removed successfully the whole femur. Trephining of the diaphysis with incision and drainage of the

joint offers a better prognosis, and the trephining, if done early, cuts the whole disease short and prevents all serious complications.