

he doubted that this exposure to extreme cold, acting locally, was the cause of the onset, at least, of the sclerotic process.

The case of M. M. bears a striking resemblance in some respects to Reynaud's disease, although its later course showed no analogy to it.

BONE AND JOINT DISEASE, A SEQUEL OF CERTAIN SPECIFIC FEVERS, ESPECIALLY SMALLPOX.

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It has long been known that periostitis is an occasional sequel of enteric fever. Attention has been drawn to this fact by several writers. Murchison¹ has recorded cases in which the femur, tibia, and temporal bone were affected—the last two becoming necrosed. In 1876 Sir James Paget² published some observations in which he pointed out that these sequels appear when the patient is *well of his fever* and in a condition of advanced convalescence. The tibia appeared to be the favorite seat of election. In several cases the ribs were affected. Occasionally the femur, fibula, ulna, radius, scapula, or parietal bones had been involved. Sir James Paget had not, however, met with periostitis and necrosis after any other than typhoid fever. Of three cases recorded by Affleck,³ the humerus was involved in two and the tibia in one. And in each instance the periostitis occurred *during the course of the fever*. Keen,⁴ who collected sixty-nine cases in which continued fevers were complicated by bone disease, regards osseous lesions as infrequent although important consequences of typhoid fever. Hayward⁵ met with several cases. In one suppuration did not occur; in a second, several long bones were attacked and suppuration followed; in a third, first the left tibia was affected and subsequently the right tibia in two places. Jackson⁶ has published a case in which periostitis of the left third rib commenced two months after subsidence of the fever, and after suppuration did not finally heal for seven months. According to Bourgeois⁷ the tibia, femur, humerus, ulna, and maxilla are attacked in that order of frequency,

¹ Continued Fevers of Great Britain, 1873, p. 582.

² St. Barth. Hosp. Rep., xii. "On Some of the Sequels of Typhoid Fever: Phlebitis, Periostitis With or Without Necrosis, especially Periostitis of Ribs," etc.

³ Quoted by Macnamara: Diseases of Bones and Joints, 1887, p. 79.

⁴ Surgical Complications, etc., of Continued Fevers, Phila. 1887. Quoted by Jones: Diseases of the Bones, 1887, p. 41.

⁵ British Medical Journal, vol. i., 1885, p. 16.

⁶ Ibid., vol. i., 1885, p. 428.

⁷ Sajous, vol. ii., 1888, p. 287.

sometimes more than one bone being affected and the left side being more often attacked than the right.¹

I have only seen one case. In this, a lad of fifteen, periostitis of the tibia occurred during the height of the fever.

Scarlatina, measles, and even chickenpox² are occasionally followed by bone or joint disease. In many cases, no doubt, they act as a predisposing cause by producing great deterioration of the general health. In others there seems good reason for supposing that the exanthematous poison may have a direct and local action. In the jaw, for instance, there is a form of alveolar necrosis accompanied by shedding of teeth which appears to be the result of the local application of a specific (fever) poison to the vascular parts of the teeth.³ Scarlatina is a potent cause; but both measles and typhoid may present similar sequelæ. Cases have been recorded by Jackson,⁴ Hillier,⁵ Smith,⁶ Poland,⁷ Franklin, and Lawton.⁸ But a larger number occur which do not find their way into print.

VARIOLA.—The literature with regard to smallpox is still more scanty. I believe that it is not generally known that after variola, too, there is a liability to bone and joint affections. Fox,⁹ in 1806, recorded two cases in which alveolar necrosis occurred after variola. Acell¹⁰ reported a case of epiphysitis in an infant eleven months old suffering with variola. In 1873 Golgi¹¹ showed that the medulla of bone is always altered in smallpox, being unusually soft and often congested. Especially is this the case in the hæmorrhagic form in which the condition of the medulla, with extravasations in its spaces, is absolutely diagnostic. McLeod¹² has described four cases of joint disease. In one, a girl aged nine years suffered two months after an attack of smallpox from symmetrical abscesses about the shoulders and elbows. Both elbow-joints were ankylosed, and a portion of the right acromion process was necrosed. In a second case, suppurative epiphysitis of the bones in both elbow-joints

¹ For further references see: Mollière (Sajous), *La Semaine Méd.*, 1887; Martha (Sajous), *E.* 24, vol. iii., 1889). Mercier, *Revue mensuelle de Méd. et Chir.*, No. 2, 1879, p. 21. Levesque, "De la Périostite dans la Convalescence de la Fièvre Typhoïde," Thèse de Paris, 1879. Routier (quoted by Hayward), *Le Progrès Medical*, 1879.

² Townsend: "Acute Arthritis of Infants," *Internat. Journal Medical Sciences*, vol. v. Holmes: *Surgical Treatment of Children's Diseases*, London, 1869.

³ S. J. A. Salter: *Holmes's System of Surgery*, vol. iv. p. 384, 2d ed. Guy's Hospital Reports, 3d series, vol. iv.

⁴ *Medical Times and Gazette*, vol. ii., 1862, p. 681.

⁵ *Lancet*, vol. ii., 1862, p. 247.

⁶ *Ibid.*, vol. ii., 1878, p. 806.

⁷ *Medical Times and Gazette*, vol. i., 1869, p. 383.

⁸ *Lancet*, vol. i., 1879, pp. 553-585.

⁹ *Treatment of Diseases of the Teeth*, London, 1806, p. 112.

¹⁰ *Archives of Medicine*, 1830, vol. iv. p. 491 (quoted by Townsend, loc. cit.).

¹¹ Jaccoud: *Pathologie Interne*, 5th ed., vol. ii. p. 705.

¹² *Indian Medical Gazette*, vol. xv. p. 94, vol. xvii. p. 114.

occurred, all the epiphyses becoming detached. In another patient abscesses formed in both legs, resulting in "stiffly flexed" knee-joints; and portions of necrosed bone were removed from the left humerus and right radius. In a fourth case necrosis of the right tibia, both humeri, and the left humerus occurred, and resection of the left elbow-joint was performed. Three cases have also been reported by Joubert.¹ One was a girl aged fifteen; both elbows were ankylosed in the straight position, and showed traces of former sinuses. There was also necrosis of both radii, from which long sequestra were removed. The right elbow was excised with good success. Then, in a boy aged ten years the left shoulder and both elbows were ankylosed in a nearly straight position. There were traces of former sinuses. Both elbows were excised with good results. The third case was a girl aged fourteen years, whose right elbow was ankylosed at an obtuse angle. This was also treated by resection. In a discussion on these cases, Ahmed² stated that he had frequently met with abscesses and ankyloses of joints following smallpox, and that elbow-joints were most liable to disease. Four other cases were published by Arthur Neve:³ (1) Disease of both elbows and one wrist-joint; simultaneous excisions; cure. (2) Complete necrosis of ulna; resection; cure. (3) Necrosis of left scapula; resection; cure. (4) Acute suppuration of shoulder-joint; incision and drainage; cure. Finally, two cases have been reported by Mitra⁴ in which the elbow and the hip respectively were affected and were treated successfully by incision and drainage.

I have been unable to find records of any other cases, although I do not doubt that in all epidemics of variola there must be a tendency for these sequelæ to occur.

In Kashmir, which is an unvaccinated State, with but few exceptions every inhabitant suffers from smallpox, usually in childhood. The infantile mortality is appalling. Of the survivors a large number suffer sequelæ, amongst which bone and joint diseases occupy a place of some importance.

I have now to add, to those cited above, twenty new cases, most of which occurred during the winter 1889-90, when there was an epidemic of unusual severity. All were either under my own care or that of Mr. Arthur Neve.

For the sake of brevity only the salient features will be noted.

CASE I. *Alveolar necrosis*.—Child, aged four years. November, 1889. Sequestrum measures one and a quarter inches by one and a quarter inches, and contains two empty sockets and one unshed incisor tooth.

¹ Indian Medical Gazette, vol. xviii. p. 230.

² Ibid.

³ Lancet, vol. ii., 1887, p. 609.

⁴ Indian Medical Gazette, March, 1890.

CASE II. *Alveolar necrosis*.—Nahira, male, aged five years. June, 1890. Sequestrum one and a half inches by three-quarters of an inch, containing two molar teeth.

CASE III. *Necrosis of right clavicle*.—Male, aged four years. December, 1887. Sinus over junction of osseous shaft with cartilage of epiphysis. A necrosed portion one inch long removed from junction of shaft with epiphysis. New bone around. Rapid recovery.

CASE IV. *Necrosis of clavicle*.—Ashi, female, aged six years. April, 1885. Separation and necrosis of sternal end at epiphyseal line. Small fragment removed. (Left femur and fourth rib on the right side also affected.)

CASE V. *Necrosis of spine of left scapula*.—Jamad Shah, male, aged nine months. January, 1890. Abscess at back of shoulder containing half an ounce of pus. Sequestrum at junction with acromial epiphysis, size of haricot bean with a thin prolongation for an inch along the scapular spine. Healed rapidly.

CASE VI. *Necrosis of spine of left scapula and disease of left elbow-joint*.—Azizi, female, aged seven months. February, 1890. Smallpox a month ago. A smooth surface of separation from the epiphysis at the acromial end of the spine. Sequestrum the size of an almond, with a long, sharp tail corresponding to the free edge of the spine. Left elbow has also been affected but is now almost healed. Joint fairly movable. A small sinus leads into it.

CASE VII. *Elbow and scapula*.—Fazli, female, aged three years. February, 1890. Right elbow-joint swollen and fluctuating. Articular ends of humerus and ulna enlarged and tender. On opening joint the trochlear surface of humerus found to be diseased. Ulceration of cartilage. Floor of carious bone. No sequestrum or ulceration of head of ulna. Arthrectomy. Recovery with movable joint. Sinus over spine of left scapula near acromion process, no sequestrum.

CASE VIII. *Elbow*.—Male, aged one year. October, 1889. Articular surfaces of right humerus and ulna ulcerated. Extensive necrosis of cartilage has occurred. Synovial membrane greatly thickened. Sinuses. Partial resection. Recovery in three weeks with movable joint.

CASE IX. *Elbow*.—Hahiba, male, aged one and a half years. November, 1889. Sinus leading into joint. Articular surfaces of left humerus and ulnar found ulcerated. No sequestrum. Carious end of ulna snipped off with bone forceps leaving cartilaginous olecranon process. Rest of joint including thickened synovial membrane removed by scraping and gouging. Delayed but satisfactory recovery with limited mobility of joint.

CASE X. *Elbow*.—Ahadou, male, aged two years. December, 1889. About a month since smallpox. Abscess of left elbow-joint with sinus at radial side posteriorly. Synovial membrane thickened and granulating. Outer aspect of articular surface of humerus and external condyle eroded with bare carious bone forming the floor of the ulcer. No sequestrum. Gouged and scraped. Rapid recovery.

CASE XI. *Elbow*.—Doulti, female, aged one year. December, 1889. Swelling of left elbow. Fluctuation. No sinus. Skin unbroken. Joint opened by posterior incision and bare bone on trochlear surface of humerus gouged. Ulcerated articular cartilage of ulna scraped. Small sequestrum from ulna, size of haricot bean. Synovial membrane erased. Rapid recovery.

CASE XII. Both elbows.—A female infant. February, 1890. On the left side suppurative arthritis with a sinus. The head of the radius was diseased and a small sequestrum removed. On the right side the articular surface of the ulna was ulcerated. The joints were scraped and the diseased bone gouged. Recovery took place with fair movement.

CASE XIII. Both elbows and multiple abscesses.—Saadhu, male, aged one and a half years. December 20, 1889. Both elbows greatly enlarged and the swelling extends up to the arms above the joints for two or three inches under the triceps. Skin unbroken. On incising under Listerian precautions, the pus was found to be thick. Synovial membrane not greatly thickened but injected, soft, and granulating. On both sides there was ulceration of the articular surface of the humerus and of the ulna. The joint cavity was thoroughly scraped with Volkmann's spoon. After a few days the use of the spray was discontinued. About December 27th an abscess appeared over the external epiphysis of the clavicle. This was incised and healed at once. About the same time a collection of pus was discovered in each leg, on the right side at the upper end of the shaft of the tibia and on the left side at the lower third. These also were opened and healed promptly. A similar localized suppuration occurred over the acromial epiphysis on the left side. This also subsided after incision without necrosis.

January 18, 1890. Left arm healed, movement free. A suppurating sinus leads into the right elbow-joint.

30th. Abscess has formed on right side of neck, not connected with bone and not glandular. A small sequestrum removed from the right elbow-joint. This was a portion of the head of the ulna. The wound then healed.

February 26. The left elbow has again begun to discharge. An arthrectomy was now performed, and a loose cartilaginous sequestrum was removed from the external condyle. There was ulceration of the articular cartilage of the ulna, the tip of which at the epiphyseal line was carious. This was followed by rapid recovery.

CASE XIV. Elbow and necrosis of ulna.—Female infant. January, 1890.—Anterior and outer articular surface of olecranon bare, and carious joint very little swollen. Sequestrum one and a half inches long from middle third of ulna. Joint cavity scraped. Speedy recovery.

CASE XV. Disease of right elbow and left ulna.—Rami, female, aged one year. February 11, 1890.—Had smallpox a month ago. Discharging sinus from right elbow. On opening the joint, articular surfaces of ulna and humerus deeply eroded. Cartilaginous tip of olecranon separated from the shaft. The cartilaginous surfaces of the bones were excised and the synovial membrane erased. The head of the left ulna was projecting under the skin near a sinus in the upper third of the forearm. The whole bone (except the styloid end) was withdrawn as a long sequestrum. The elbow-joint was unaffected, being separated from the necrosed shaft by the cartilaginous epiphyseal tissue of the olecranon. The dead bone showed no signs of osteitis or other morbid change, except partial disintegration just below the lesser sigmoid cavity. Its death had evidently been rapid and complete.

Rami was dismissed on March 14, 1890. The left ulna was being rapidly re-formed. The child was weakly, but it was hoped that she would pick up strength. There was free movement of the left elbow, and fair on the right side.

CASE XVI. Disease of left ulna and left knee-joint.—Kougi, female, aged two years. February 3, 1890.—A sequestrum of the ulna exactly similar in every respect to Case XV. Healing was equally rapid. In the knee-joint both the femur and tibia were profoundly diseased. Beneath the external condyloid cartilage at the epiphyseal line there was an area of softened diseased bone the size of an almond. From this a sinus passed through the ulcerated cartilage to the joint. In the head of the tibia was an abscess cavity containing the epiphyseal nucleus as a loose sequestrum. This cavity communicated above with the joint, and anteriorly there was a sinus communicating with the open air. Thus there was suppurative arthritis with double epiphyseal abscesses, the tibia being the more severely affected. Arthrectomy was performed and gouging. When the child left (March 14, 1890) there was still some discharge from the sinus. One knee had consolidated much, but the limb was distinctly flail-like.

CASE XVII. Necrosis of Ulna.—Zuni, female, aged ten months. June, 1890.—Had smallpox three months ago. Now a deep scar two inches long immediately below olecranon, and at middle third of left ulnar border of forearm a sinus communicating with dead bone. From this I withdrew a cylindrical sequestrum two inches long, evidently the remains of a completely necrosed ulna. The wound healed in a few days.

CASE XVIII. Disease of the knee-joint.—Ramzana, male, aged two years. March 31, 1890.—Had smallpox two months ago. Knee swollen and evident synovial thickening, with enlargement of articular ends of femur and tibia. Pus thick. Head of tibia deeply eroded and necrosis of the epiphyseal nucleus. This was removed and the synovial membrane erased. The patient was discharged on May 12, 1890, quite well. The knee was not stiff.

CASE XIX. Sub-periosteal abscess of femur.—A boy, aged three years. February, 1890.—Knee painful for twenty days. Deep, indistinct fluctuation behind and above knee. On incising to the bone above the condyle on the outer side, a small collection of sero-purulent fluid was tapped. The child recovered without necrosis.

CASE XX. Necrosis of humerus (epiphyseal).—Lassoo, male, aged seven years. May 31, 1890. Had smallpox one and a half months ago. Great œdema of upper extremity. Two sinuses, one at the upper the other at the lower end of the humerus, each leading to dead bone. Sequestra were removed from each of these positions. The upper was about two inches long, and evidently connected with the epiphysis. The head of the humerus appeared absorbed. The lower sequestrum was apparently also juxta-epiphysary. The shaft of the bone was much thickened, and there was some stiffness of the elbow-joint. The discharge rapidly subsided. The boy was dismissed June 28th. It is possible that a further sequestrum may separate from the shaft of the bone at some future time.

ETIOLOGY.—It is not surprising that organs occupying such a large area, and discharging functions so important as the bones and joints, should occasionally suffer after certain specific fevers. The intimate nervous and vascular relationship of the joints to the skin by which they are covered, the affinities of endothelium and epithelium, the important vascular supply of bones, especially of the medulla and

articular ends, the blood-forming properties of the marrow, and in the case of the teeth and alveolar processes, the dermal origin and extraordinarily active developmental changes, all tend to mark out the joints and bones for participation in the morbid processes set up by specific fever poison.

In most of the continued fevers, abscesses of soft tissues may occur as sequelæ. In typhoid we know that there is, in addition to more obvious changes, a scattered minute lesion to be found oftentimes in the mesenteric glands, spleen, and liver. This, which is of the nature of a localized cloudy swelling, is probably infective, although I believe that hitherto the typhoid microorganism has not been demonstrated in it. In most cases resolution occurs. But it is not difficult to see how predisposition of the patient and intensity of the poison might favor suppuration. Now, in enteric fever, which is a disease *totius substantiæ*, it is probable that the abscesses which form (whether periosteal or not) have an origin of this nature.

But while the same tendency exists in other infectious febrile diseases, nowhere is it more marked than in smallpox. In the confluent variety especially, the formation of boils and abscesses is common. And in a suppurative disease like variola it might be anticipated that symptoms of a pyæmic nature would sometimes occur. The poison is absorbed by the lymphatics and passes on into the small veins, from which it is scattered far and wide. It is by no means improbable that multiple abscesses in smallpox may thus have an embolic origin. To some of the cases recorded above this affords a ready solution. But although the mechanism of production may be similar to that of pyæmia, the poison is, I take it, distinct. The abscesses are free from putrefactive odor and run an aseptic course under strict Listerism. It is an interesting point as to whether the pus from such a joint is capable of reproducing smallpox if inoculated. For it is a post-variola condition, and the joint affection does not coincide with the skin eruption.

What determines the sites of manifestation? Why is the upper extremity so frequently affected? For as far as epiphyseal nuclei are concerned the development of the upper extremity is much later than that of the lower, and, therefore, it might be regarded as less prone to disease. But on the other hand, I think that a young infant uses its arms more than its legs, and so the former are more liable to injury. Again, in Eastern countries where the lower half of an infant's body is warily reposing within its mother's dress, the arms are certainly more exposed to cold. Moreover, there is often a greater development of pustules on the upper half of the body, and this might influence, through the lymphatics, the site of a suppurative lesion.

The seat of election in the bones is either at the epiphyseal line or else under the periosteum. In cases of complete necrosis, as, for instance,

those of the ulna, both sides may be attacked, and it is difficult to ascertain which is the primary lesion.

The selection of these points for attack is due partly to their developmental activity and consequent vascularity. In the case of the epiphyses the junction of the rigid shaft with the more yielding cartilage offers a condition favorable to mechanical strain and injury. Any other predisposing cause (whether hereditary, as syphilis, or not), would have due weight,¹ in favoring bone disease.

Pathology.—The thirty-six cases of bone and joint disease after variola cited above can be grouped into divisions. Thus, there were four cases of alveolar necrosis. Twenty-one patients suffered from bone disease with necrosis. Twenty-six suffered from joint disease. In twelve cases one or more epiphyses were affected.

Disease was more frequent in the upper extremity. Eighteen patients suffered from disease of the elbow-joint. In several of these the lesion was bilateral, so that there were twenty-five elbow-joints affected. In six instances there was disease of the scapula. The other figures stand as follows: Necrosis of ulna five, clavicle three, radius three, humerus two, disease of shoulder-joint two, wrist one. This gives a total of twenty-eight joint lesions in the upper extremity and fourteen bone affections. While in the lower extremity only five joints were diseased and nine bones, viz.: knee-joint four, hip-joint one, tibia four, fibula three, femur two.

Alveolar necrosis is probably less common after smallpox than after some other eruptive fevers. The affections peculiar to variola may be considered conveniently under the headings: (1) Joint disease, (2) epiphyseal disease, (3) bone disease.

1. *Joint disease.* I have already shown how frequently the elbow is affected. In seven cases the disease was bilateral. In the rest it appeared to occur with about equal frequency on the right and left sides. The condition is essentially subacute. The articular ends of both humerus and ulna are apt to become enlarged. The muscles are not distinctly wasted. In several cases the ligaments are much relaxed. The synovial membrane is thickened and presents a velvety appearance. Ulceration of the articular cartilages is invariably present. The ulna and humerus appear to be affected with equal frequency. In the former the upper bony tip of the olecranon end of the shaft often forms the floor of the ulcer, and there is a distinct tendency to the casting-off of a small sequestrum. In the humerus the trochlear surface is usually eroded. In several cases this has proceeded so far as to destroy all form and to leave the lower end of the bone as a convex, ulcerated surface with patches of carious bone in the floor. In other cases there is detachment of one or more epiphyses. It is rare for the radius to be

¹ "Etiology of Bone Disease," by E. J. Neve. Indian Medical Journal, 1888-89.

affected. When sinuses exist they are usually found close to the upper end of the olecranon process on the outer or inner side.

It appears probable that there are here two types of elbow disease. One is a *primary arthritis*—the joint becoming affected as a whole. For in several of the above cases the different structures of the articulation appear to be involved in a common disease. In fact, it may be said that where the epiphyses are not obviously affected we have probably to deal with a general arthritis. And even sometimes when the epiphyses are detached late in the course of the disease it is only a part of the general process of disintegration. Where *primary epiphysitis* has occurred the disease can be localized to the epiphyseal line or else is found to be more severe at that position.

2. *Epiphyseal disease.* If arthritis of the elbow is the typical joint sequela of smallpox, there are some forms of epiphysitis which are hardly less characteristic. Such, for example, are the instances of disease of the acromial and clavicular epiphyseal lines in which the focalization of the lesion is most precise. But in the long bones also the same tendency is observed. Thus, in one case both ends of the humerus were attacked. In the examples of entire necrosis of the ulna it will be observed that in four cases the elbow-joint was unaffected, although separation had taken place at the epiphyseal line above the olecranon process of the shaft.

In the knee-joint, however, the tendency for an epiphysitis to involve the articular cavity is great. I have noticed this before in other cases than smallpox. But it is well illustrated by cases XVI. and XVIII.

3. *Bone disease.* Apart from caries and small sequestra occurring in the diseased joints, bone disease occurs chiefly in three forms after variola, viz.: Complete necrosis, partial necrosis, and subperiosteal abscess. There were four cases of *complete necrosis* of the ulna. In all of these the bone was unchanged, except in so far as disintegration had set in. There was no evidence of osteitis.

The death must be regarded as due to subperiosteal suppuration. In such cases it appears that separation at the epiphysis may have been either primary or secondary. If the former, the periosteal suppuration may have arisen at the epiphysis. If the latter, then the suppurative periostitis was the primary disease, the epiphysis becoming involved subsequently. We can understand that in such a case as that of Sandhu (XIII.) the subperiosteal abscesses might in the absence of treatment have produced death of the tibial shaft. In one case there was almost complete necrosis of both radii. *Partial necrosis* occurred twice in the left fibula and once in the right fibula, right tibia, and right radius, left ulna, left humerus, and left scapula. *Subperiosteal abscess* without necrosis occurred twice in the femur, twice in the tibia, and also on the fourth rib.

DIAGNOSIS.—The history and period of onset of these diseases is characteristic. A bone or joint lesion occurring in an infant or young child three or four weeks after smallpox and running a subacute course with suppuration, leaves little doubt as to its nature. The patients are usually profoundly pock-marked with recent scars. Cases seen for the first time as late as two or three months after smallpox show from the advanced state of their lesions that the condition must have arisen soon after, if not during, convalescence.

TREATMENT.—In many cases the treatment required is extremely simple. Incision and drainage of subperiosteal collections is sufficient. Sequestra become separated with great rapidity (in spite of the otherwise subacute course of these diseases) and can be readily removed. In the joints simple incision and drainage are sometimes productive of good results, but they are more frequently followed by prolonged suppuration and final ankylosis. So the choice really lies between modified excision and arthrectomy. I think that the joint should be freely laid open and the synovial membrane removed as far as possible. The amount of articular cartilage removed must depend upon the extent of the disease. But generally the surgeon should aim at removing sufficient to diminish the risks of ankylosis and yet avoid interference with epiphyseal growth.

Owing to the age of the patients recovery is usually rapid. Indeed, even if left untreated, there is a strong tendency to natural cure, whether by spontaneous extrusion of sequestrum or by suppuration and ankylosis of joints.

SUMMARY.—*a.* Periostitis, epiphysitis, necrosis, and arthritis may occur after and on account of exanthemous fevers, especially smallpox.

b. They usually, but not invariably, appear during late convalescence.

c. In *typhoid* fever the most frequent of these sequels is periostitis. And this attacks long bones by preference, especially the tibia, but seldom results in necrosis. Arthritis, if it ever occurs, must be extremely rare.

d. Alveolar necrosis is of not infrequent occurrence. It is a commoner sequel of scarlatina and measles than of the other exanthemata.

e. After smallpox—

(1) Arthritis, the most characteristic lesion, occurs with greatest frequency in the elbow, and less often in the knee, shoulder, hip, and wrist. Sometimes it is primary. Occasionally it is secondary to epiphysitis.

(2) Next in frequency is partial or entire necrosis of long bones, especially the ulna.

(3) Suppurative epiphysitis with or without necrosis is not uncommon. The acromion is frequently attacked, as are also the long bones.

(4) These post-variolous diseases occur chiefly, if not entirely, in

infants and young children, and are often multiple. They are subacute and a fatal termination is rare.

f. The various conditions enumerated above have a tendency to spontaneous recovery by suppuration, extrusion of sequestra, and ankylosis of joints.

g. As treatment, incision and drainage, with removal of sequestra, is usually sufficient. But in cases of arthritis, prolonged suppuration and ankylosis may be avoided by arthrectomy or partial resection of the joint.

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SURGICAL AND MECHANICAL TREATMENT OF THE DEFORMITIES FOLLOWING INFANTILE SPINAL PARALYSIS.¹

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The pathology of infantile spinal paralysis, or anterior polio-myelitis, is not considered in this article, since the object of the paper is to deal only with the severer grades of resultant deformities.

These deformities are produced by muscular atrophy, degeneration, and contracture, together with want of bone-growth, and the distortions which result from locomotion. The deformities are frequently so great that the individual spends his life upon the floor and the members become so misshapen that they are mechanically unsuited for locomotion even could muscular power be restored. This paper is intended to deal almost exclusively with this class of cases—the ones ordinarily considered hopeless cripples.

Locomotion, however, even in these cases, is often possible by the proper application of surgical means together with the skilful use of mechanical appliances, thereby greatly augmenting the usefulness, the health and the happiness of the individual.

The limbs must first be brought into such position that they will assist in sustaining the weight of the body, or be incorporated as a part of the apparatus to sustain such weight, either with or without crutches.

Surgical measures offer the most rapid and efficient hopes for relief. To attempt to rectify these members by mechanical means alone is to inflict an unwarrantable amount of pain, time, and expense without accomplishing any better results than can be secured by vigorous

¹ Abstract of a paper read at the Tenth International Congress, Berlin, 1890.