BENIGN FORM OF ACUTE OSTEITIS OF THE SPINE IN YOUNG CHILDREN

BY

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During the year ending April, 1951, we had under our care seven young children suffering from what we believe to have been a low-grade pyogenic osteitis of the lumbar spine. The strikingly uniform clinical picture observed in these children does not seem to have been satisfactorily described, and we think it worth while to record our experience of it.

The children were aged between 9 months and 2½ years at the onset of the illness, which seems to be insidious

and undramatic. The parents did consult the family doctor within the first few days in all cases, but most of them were not unduly worried by the delay of up to four weeks which occurred before the children were referred for a second opinion. There was in most cases a further delay before admission to hospital. That this was due to the very misleading impression which the parents and children may give during an out-patient consultation and examination is apparent from Table I. The children were initially seen by five different consultants.

TABLE I.—Summary of Out-patient Experience

Case No.	Age on Admission	Duration at First Visit	Initial Diagnosis by Consultant	Duration on Admission
	Yrs. Mths.			
1	2 2	2 weeks	Pott's spine	3 weeks
2	1 7	4 "	Painful limp	4 "
3	2 4	2 "	? Encephalitis	6 "
4	1 1	1 week	Abdominal pain	2 "
5	1 5	3 weeks	? Hip lesion	5 "
6	11	4 "	? Urinary infection	10 "
7	1 7	½ week	Limp? Sacro-iliac joint	3 "

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIGS. 1, 2, 3, and 4.—A case of benign acute osteitis of fifth lumbar and first sacral vertebrae; patient aged 1 year and 7 months. X-ray films at 4 weeks, 13 weeks, 26 weeks, and 1½ years after the onset, showing early appearance of recalcification (at 13 weeks) and later sclerosis, with some bridging of the disk space posteriorly.

On admission to hospital, however, with the opportunity for more leisurely and detailed history-taking and examination, these seven children presented a strikingly uniform clinical picture. The constant outlines of the picture of spinal disease were only slightly blurred by variation in the severity of the symptoms. In four cases there was superimposed upon it a "hip syndrome" (limp, with some limitation of movement). Though at first this was misleading, we later came to regard it as reassuring evidence that the spinal lesion was likely to be pyogenic rather than tuberculous.

At the onset in all cases the symptoms of a mild or moderate febrile illness and those of a spinal lesion appeared within a few days of each other. Irritability, loss of appetite, and feverishness had been noticed in most of the cases; and a previously active child would develop a stiff back and begin to have spasms of pain and later object to sitting or walking, or even to being handled (though he might remain surprisingly active for some weeks in any posture which avoided flexion of the spine). These symptoms usually increased in severity very gradually for up to five to six weeks and then became stationary or began to improve. The four children with the "hip syndrome" were noted to have a well-marked limp at the onset or within the first two weeks of illness; and in three of them these symptoms had cleared up by the time of admission to hospital.

On examination the children were very mildly or at most moderately ill. There was evidence of weight loss in six of them. Case 7 was apyrexial throughout his hospital stay of 10 days; the rest had temperatures

ranging up to 103° F. (39.4° C.). All objected strongly to sitting up; two were still prepared to crawl on all fours or even to stand with support. On the whole they preferred to lie prone in their cots, when they would appear comfortable and play with their toys, though very liable to an occasional interruption by a bout of pain, apparently produced by movement. The lumbar spine was held fixed in slight lordosis by spasm of the paravertebral muscles, and we noted that attempts to flex the spine passively were more strongly resisted than was hyperextension. There was no neck stiffness. Only Case 4 had tenderness of the spinous processes of the affected vertebrae.

X-ray films of the lumbar spine showed narrowing of a disk space, with erosion of the adjacent margin of the body of either or both the vertebrae bounding it, as seen in the lateral view (see Fig. 1). These changes were evident at the time of admission in six cases, but not definite until two weeks later in Case 4. In Case 3

there was also a posterior displacement of the upper of the two affected vertebrae. In Cases 5 and 6 the anteroposterior view showed an angular scoliosis at the level of the lesion (see Fig. 5). In every case the Mantoux test was negative to a dilution of 1/100. The Wassermann reaction and agglutination tests against the *Salmonella* group and *Brucella abortus* were also negative.

All the children were treated by rest in a plaster bed (six of them being sent home in their beds

FIG. 5.—Patient aged 11 months: Benign acute osteitis of third and fourth lumbar vertebrae. X-ray film taken at 10 weeks from the onset, before the period of immobilization in a plaster bed.

and kept under observation as out-patients). Case 4 received penicillin in addition. They were allowed up again, without any restriction in their activity, after periods ranging between 7 and 22 weeks from the onset. They have subsequently been followed for between 4 and 16 months, and all remain well.

Brief case histories of four of the cases give an idea of the range of variation in detail within the uniform general outline of the clinical picture.

Case 1

A girl aged 2 years and 2 months was admitted with her mother on March 21, 1950, with a provisional diagnosis of Pott's disease. Three weeks previously she had refused to get out of her cot one morning: her back seemed very stiff and remained so up till the time of admission, particularly when walking or picking things up off the floor. She would cry out as if in pain at times, and began to wake crying during the night. She remained fairly cheerful, and her appetite was very little impaired. X-ray examination in the out-patient department a week before admission had shown narrowing of the disk space between the fourth and fifth lumbar vertebrae with some erosion of the adjacent margins of these two vertebral bodies. Her temperature on

admission was 99.8° F. (37.7° C.). She was not obviously ill, but there was evidence of some weight loss. She was quite active and would even walk with support, but objected to sitting. Her lumbar spine was held fixed in slight lordosis, with marked spasm of the paravertebral muscles; no localized tenderness was found. She was sent home in a plaster bed to be nursed by her mother, and was not allowed out of her plaster bed until 22 weeks from the onset. Sixteen months later her back was still clinically normal.

Comment.—This case was the mildest in our series in respect of both local disability and constitutional disturbance. The patient was immobilized for a much longer period than we now consider necessary; she was the first case we saw and we were not familiar with the course of the disease with which we were dealing.

Case 4

A girl aged 1 year and 1 month was admitted with her mother on October 11, 1950: the provisional diagnosis was perinephric abscess. Her father was suffering from an attack of boils when, three and a half weeks before admission, the child had a number of screaming attacks one day and appeared to be in pain. These attacks recurred with diminishing frequency for several days, lasting up to two hours at a time: and she then became quite well again for four days. Two weeks before admission she began to get attacks of pain again: she cried if sat on her pot, and in her high chair would shuffle her bottom forward till she was nearly lying on her left side. She would no longer attempt to walk. At the same time she became feverish, and ate less than usual. She got steadily worse, and by the time of admission the parents had learnt to leave her lying in her cot, not daring to pick her up even to try to comfort her. She had eaten nothing at all for the previous four days.

On examination she was seen to be moderately ill. Her temperature was 103° F. (39.4° C.); there was no evidence of weight loss. She lay on her back comfortably, but her lumbar spine was held stiff and there was well-marked tenderness of the spinous processes of the fifth lumbar and first sacral vertebrae. The spleen was enlarged to $\frac{1}{2}$ in. (1.3 cm.) beyond the costal margin. A scanty growth of haemolytic streptococcus and *Staphylococcus aureus* was obtained from her throat swab. X-ray films at that time were only suspicious, but two weeks later definite changes had developed in the fifth lumbar vertebra with narrowing of the disk space below it. The contact history, the degree of constitutional disturbance, and the splenomegaly all seemed indications for penicillin therapy: she received 50,000 units intramuscularly every three hours for three weeks. She was put into a plaster bed during her stay in hospital, and was sent home on October 31, by which time all tenderness had disappeared. She was allowed out of her plaster bed seven weeks from the onset of the progressive symptoms of spinal disease, and remained clinically well a year later.

Comment.—This child was the most severely ill in our series, and was the only one treated with penicillin. Her temperature became normal after one week's treatment, which is the expected course in severe osteitis of long bones responding to antibiotic therapy. It was impossible to be sure whether the drug affected the course of the disease, but it is noteworthy that the period from onset to resumption of unrestricted activity was shorter in this case than in any other.

Case 2

A boy aged 1 year and 7 months was admitted with his mother on May 31, 1950, for investigation of a painful limp. The mother had developed tuberculosis five years previously and her artificial pneumothorax had been let out ten months before we saw her. Four weeks before admission the boy had begun to limp on the left leg, and held his back stiff with his tummy sticking forward when

walking. During the second week he refused to walk, but crawled actively on all fours; he also refused to sit properly in his high chair, shuffling forward until he was half-lying on his right buttock. His appetite became poor; he was very miserable, and often woke up crying through the night. During the third week his general condition deteriorated further: he refused to eat anything at all, and was losing weight. By the fourth week he would no longer crawl; he refused to go into his high chair at all, and took his drinks lying in his cot. He was obviously feverish.

Examination was made difficult by his terror of being handled, and had to be completed under light sedation. He was moderately ill, with a fever of 100° F. (37.8° C.) rising to 102° F. (38.9° C.), and evident loss of weight. The left hip was held in 45 degrees flexion; extension and both rotations were resisted towards the limits of the normal range, but flexion was full. His lumbar spine was held stiff by spasm, and if he was sat up the lordosis became exaggerated; he preferred to lie prone with his head supported by his arms. No tenderness was found. An x-ray film showed the typical lesion involving the fifth lumbar and first sacral vertebral bodies; the appearances in the hip were normal. He was sent home in a plaster bed to be nursed by his mother (in whom we had found no evidence of active tuberculosis). He was allowed up again seventeen weeks from the onset. His back was still clinically normal fourteen months later.

Comment.—This was the only case in which the symptoms and signs of the "hip syndrome" were still present on admission. We were then unfamiliar with it, and strongly suspected two lesions (probably tuberculous in view of the mother's history). The hip signs cleared up in under a week, and relieved our minds on that score; the likelihood that the spinal lesion was tuberculous was excluded by the negative Mantoux test and by the subsequent course of the x-ray changes. We were again overcautious about releasing from immobilization this case of what was still an unfamiliar disease at that time.

Case 5

A boy aged 1 year and 5 months was admitted with his mother on November 15, 1950. The final choice of diagnosis in the out-patient department lay between osteitis of the spine and urinary infection. Five weeks previously he had fallen off a step 6 in. (15 cm.) high, appeared to have hurt his back, and refused to walk for two days, crying bitterly and frequently. He then improved for a week, but walked with a marked limp and undue prominence of the right hip. His back seemed stiff and abnormally arched. After this first week he deteriorated steadily again. He preferred crawling to walking. By the time of admission he virtually refused even to stand, and completely refused to sit on his pot, so that he passed water infrequently, and only when lying down. During the third week after the injury his appetite began to fail and he appeared to be losing weight. He also began to have screaming attacks lasting five minutes or so, during which he would clutch his right leg, but his mother could not be sure where the pain was.

On examination he was only slightly ill; his temperature was 99.4° F. (37.4° C.), and there was evidence of weight loss. He could lie flat in any position and crawled fairly freely on all fours, but resented attempts to make him sit or stand. His lumbar spine was held fixed in slight lordosis: no deformity or tenderness was detected. X-ray films showed the typical lesion at the level of the fourth and fifth lumbar vertebrae, but with minimal bone involvement as yet. He was left free in his cot for two weeks, and began to stand and even to sit spontaneously, and was eating better. But he developed an angular scoliosis, convex to the right, at the level of the lesion. This was obvious clinically and radiologically, and it was decided to put him into a plaster bed, in which he was sent home. He was allowed up again eleven weeks after the initial injury, by

which time the scoliosis was no longer detectable clinically and was much improved radiologically. This improvement was maintained ten months later.

Comment.—This is the only case with a clear history of an injury at the onset. His "hip syndrome," which dominated the picture at first, was no longer evident by the time of admission. He is one of two cases which had an angular scoliosis that was very much improved by a brief period of immobilization in a plaster bed.

Discussion

We are far from certain about the exact pathology of the condition from which these children suffered. But we think, after considering the clinical and radiological evidence, that it is probably the same condition as that form of "osteomyelitis of the spine" which has been variously described as "benign" (Smith, 1933), "gradual" (Butler *et al.*, 1941), and "chronic" (Flemming, 1935; Martin, 1946). A similar form is mentioned in the more general accounts of osteomyelitis of the spine by Wilensky (1929), Kulowski (1936), and Guri (1946). There is no direct evidence about the pathology in these reports, but there is ample direct and indirect bacteriological evidence that the infection of the spine is staphylococcal. Our confidence that the condition they describe is the same as that which we have been seeing is not very great in the case of some of these reports, none of which is concerned with patients in the same age group as ours; but we feel reasonably sure about Guri's (1946) 19 cases "with a gradual onset," since he makes up for lack of clinical details by insistence on the difficulty of distinguishing them from cases of tuberculous spondylitis, and also reproduces some x-ray films which are adequate for purposes of comparison. In four of these cases an abscess developed over the lesion in the spine, and *Staph. aureus* was grown from the pus, while another five cases had a focus of gross staphylococcal infection elsewhere in their bodies. These observations have weighed heavily with us, since in only one of our much younger patients (Case 4) did we find even indirect evidence of staphylococcal infection. Somewhat similar lesions have been described complicating brucellosis and salmonella infections, but all agglutinations were negative in our cases. Having concluded that the infection of the spine is probably staphylococcal, we have also accepted the view (embodied in the titles of the reports quoted above) that the pathology is likely to be a haematogenous infection of bone.

A different view of the pathology is put forward by Saenger (1950) in the most recent report we have seen. His "spondylarthritis in children" is the same condition as we have described: we are in no doubt about that, since he publishes fuller details and more complete series of x-ray films than any previous author. Three of his four cases were in the same age group as ours, and he argues from the admittedly better blood supply of the intervertebral disk in the young child that the infection is more likely to start in the disk itself, with only secondary involvement of the adjacent vertebrae. Yet he describes as "analogous" the condition of "acute infectious lesions of the intervertebral disks" described by Ghormley *et al.* (1940), although the youngest of their 20 cases was 9 years old, and their average age 34 years.

As to the age incidence, only Saenger has reported the condition in toddlers. Indeed, Butler *et al.* state that the sudden and fatal form of the disease occurs "as a rule" in children, and is relatively common; while they regard the form with a gradual onset as rare enough to make it worth while publishing a single case, adding that "this type is most often seen in adults." This would be in surprising contrast to the behaviour of osteitis in other sites. Excluding the neonatal period, we see eight mild cases for every severe one under the age of 3 years, whereas between 3 and 12 years the proportions are almost reversed. The discrepancy as regards age incidence between previous reports and our own experience is probably partly explained

by a freakishly high incidence of the condition in this part of the world during the year in question. But it also seems possible that some of the cases which do occur escape recognition.

That the diagnosis of osteitis of the spine may be difficult in any age group is generally agreed. One would expect the difficulty to be greater when the disease occurs in a benign form in a child who is not old enough to make known the site of his pain. The facts recorded in Table I lend some support to this view. However, little harm would probably be done in most cases by failure to detect the presence of a spinal lesion: the child is likely to make a satisfactory recovery without any treatment other than rest in bed during the active stage of the infection. The chief penalty would be the unnecessary anxiety on the part of relatives and doctors resulting from uncertainty about the cause of the trouble. The more worrying possibility is that some of these cases may be diagnosed and treated as cases of tuberculous spondylitis. This danger was emphasized by Smith: of his 17 cases, with an average age of 29 years, 11 had originally been diagnosed as tuberculous. Kulowski and Guri have been impressed by the same danger. Reference to the case histories of our children makes it clear that the differentiation will usually be impossible on the history and examination alone. However, the presence of the "hip syndrome" noted in four of our cases may lead one to suspect the correct diagnosis, since, so far as we know, it is much less common in cases of tuberculous spondylitis. Two of Saenger's cases presented the same picture; and so did two of Guri's more severe cases. Fortunately, from the patient's point of view, the tuberculin skin test will nearly always be negative in these young children, so that further confusion should be avoided. And, more important still, one can confirm opinions based on this evidence, and avoid unnecessarily prolonged immobilization in cases in which a skin test is positive for reasons not connected with the spinal disease, by observing the course of the x-ray changes.

In the early stages the x-ray films of the pyogenic lesions seem to us indistinguishable from those seen in tuberculous spondylitis of about the same duration. The picture at that stage has already been briefly described and can be seen in Fig. 1. The subsequent course of the destructive changes is very different in the two diseases, however. Recalcification of the eroded portions of the vertebral bodies is already evident within three months of the onset in the pyogenic cases; actual sclerosis soon follows (our findings are set out in Table II and illustrated by Figs. 1-4). The striking contrast between this course and that of tuberculous cases should enable the two conditions to be distinguished with confidence at this stage of the disease.

On the question of treatment there are two different aspects to be considered. Appropriate chemotherapy would seem to be indicated if we assume (as we now do) that the infection is a staphylococcal one. But by the time we reached this conclusion we had seen two cases run a satisfactory course without it, and have subsequently withheld it unless there were clear indications for its use (as in Case 4). Saenger used penicillin in two of his cases, with no more conclusive results than our own. The second aspect concerns the orthopaedic measures to be used. All our cases were immobilized in plaster beds for varying periods (see Table II).

TABLE II

Case No.	Weeks Elapsing from Onset till		
	Immobilization Started	Recalcification Evident in X-ray Films	Immobilization Ended
1	4	7	22
2	6	13	17
3	8	11	11
4	3	7	7
5	8	13	17
6	11	17	17
7	4	10	10

We know of a patient, not treated by us, who has made a good recovery without ever having been immobilized at all: he restricted his own activity by lying in his cot until eleven weeks from the onset, and then gradually resumed normal activity. But in our view the use of a plaster bed during the stage of active infection is justified in most cases by the way in which it relieves the children's anxiety about being handled and contributes to their comfort: in cases with an angular deformity there seems to be a more direct indication for its use (see summary of Case 5, and Fig. 5). But we believe, after our experience with Cases 3, 4, 5, and 7, that it is usually safe to allow unrestricted activity as soon as recalcification is evident on the x-ray film (by which time the spine was clinically normal in all our cases). Cases 1 and 2 were immobilized longer than they need have been for reasons explained. Case 6 was immobilized for an extra month because it took that long for the x-ray appearances of the angular scoliosis to improve. Saenger was much more cautious. He used casts or braces in his first three cases for periods of seven months, a year, and seven months respectively. His fourth case seems to have been a very unusual one: he was not seen and treated until five months after the onset, and this may possibly explain why he still had to wear a body brace three and a half years later.

The ultimate prognosis for these children is not known. All our cases were still well when last seen at periods ranging from four to sixteen months after resuming unrestricted activity. We have been fortunate enough to obtain details of a case of a patient aged 1 year admitted to the Ashford County Hospital, Middlesex, in 1943, and subsequently followed for a period of five and a half years. He was still clinically normal and tuberculin-negative at that stage of his follow-up, but the grossly abnormal x-ray appearances seen in Fig. 6 had developed in spite of his having been immobilized in a plaster bed for eight months initially. None of our cases has yet shown signs of developing such bizarre radiological appearances, though sclerosis of the affected bone persists in all of them, with probable narrowing of the affected disk space. We have not seen convincing evidence of the "restoration of width" of this space, which Saenger claims for three of his cases, but we find this interesting point difficult to decide. In addition to minor variations in radiographic technique, one has to allow for the relative narrowing of disk spaces in proportion to the height of the vertebral bodies which occurs in the unaffected portions of the spine during the normal course of development at this age. It remains to be seen if any disability occurs in later life, since it appears that a radiological abnormality persists.

Summary

The clinical picture of a benign inflammatory disease of the lumbar spine which we have seen in seven children under the age of 3 years is described. There is circumstantial evidence in previous reports to suggest that the lesion is a staphylococcal osteitis.

FIG. 6.—Ashford case. Aged 1 year on admission. X-ray film taken 5½ years after the onset of benign acute osteitis of second and third lumbar vertebrae, showing gross residual radiological changes in a clinically normal boy.

The clinical picture is strikingly uniform from case to case, and strongly resembles that of tuberculous spondylitis. The distinction may be made by the tuberculin skin test, and is confirmed by the appearance of recalcification in the x-ray films within three months of the onset in the pyogenic cases.

We believe that it is wise to immobilize these children during the active stage of the disease, but that unrestricted activity can safely be allowed as soon as recalcification is evident in the x-ray films.

We are most grateful to Mr. J. A. Cholmeley and Mr. N. M. Matheson for information about the case treated at Ashford in 1943, and for permission to reproduce Fig. 6; also to Dr. Donald Court, who brought the case to our notice. We are also much indebted to Mr. J. K. Stanger for his helpful criticism of this paper.

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PATHOGENESIS OF HODGKIN'S DISEASE

BY

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Is Hodgkin's disease caused by the elementary bodies, and its malignancy by the allergy aroused by them? Both of these questions have been raised by the results obtained during the later stages of a combined clinical and pathological study of the aetiology of lymphadenoma. Investigation began when Mrs. T. E. Rose founded the Rose Research on Lymphadenoma in memory of her daughter, who lost her life from the disease, and also because lymphadenoma appeared to be a condition eminently in need of investigation. The fund apportioned for this research consisted of an endowment for a period of 10 years, and it was administered by the medical school and staff of St. Bartholomew's Hospital. An invaluable part was played also by St. Bartholomew's men in practice, who kept a keen look-out for acute cases and forwarded lymph glands removed by biopsy without preservative of any kind, so that if a piece should prove positive on section the rest of the gland could be used for bacteriological examination or animal test.

When the Rose research ended, the investigation was continued for the Medical Research Council, as it formed an important part of the study I was then making of virus infections generally, but mainly of vaccinia, psittacosis, and Shope's fibroma, with a view to applying the information thus obtained when searching for evidence of a virus infection in diseases such as the present one.

Although the most careful research had failed to reveal the presence of micro-organisms of known pathogenic significance in cases of Hodgkin's disease, elementary bodies (E.B.s) were found to be present in large numbers in most of them, particularly when the disease was in the acute

stage. In one of these in which the condition resembled acute tuberculosis—the glands being soft and almost purulent—films of them stained for tubercle bacilli showed no acid-fast organisms, but when the same film was counterstained with Löffler's methylene blue for several hours at 37° C. swarms of E.B.s stained blue were visible when it was mounted in water and examined microscopically. As these E.B.s were similar in morphology to those seen in other virus infections in which they have now been established as the actual *materies morbi*—for example, vaccinia—it was decided to prepare a vaccine of these Hodgkin bodies, and, after its attenuation by heat, to test its effect.

The late Dr. A. E. Gow, then senior physician to the hospital, co-operated in this, and it was found that a patient suffering from lymphadenoma was extremely allergic to even a minute dose of the E.B. suspension; so that attempts to immunize her with it were out of the question. This difficulty, however, was surmounted in the same way that had succeeded in acute cases infected by bacteria—namely, by uniting them with the specific antibodies present in immune serum before injection, and then giving the flocculated antigen a series of washings in saline so as to get rid of the serum. This sensitized E.B. vaccine was given a thorough trial in cases of lymphadenoma by Dr. E. C. Warner, who has reported on the encouraging results obtained in a large proportion of the patients, especially in young adults at an early stage of the disease. The relief, however, was only a temporary one, as lymphadenoma is a form of malignant disease at present.

When these results with the sensitized E.B. vaccine were published *La Presse Médicale*, of Paris, printed a note on the treatment, and the information spread to Chile, where great interest was aroused, as Hodgkin's disease is met with there as also in other parts of South America. Through Dr. Maxwell Chance, physician to the Chilean Legation in London, some of the sensitized E.B. vaccine was sent to Chile and tried there. Further particulars are given in the following brief account.

Photomicrograph of Hodgkin elementary bodies. ($\times 1,250$.)
 (From the Rose Report on Lymphadenoma, 1932.)

The following Chilean cases were treated by E.B. vaccine in 1937, and the report on them was received through Dr. Chance and translated by him from the Spanish in July, 1937.

Report on Chilean Cases

(Lymphadenoma sensitized vaccine. Specimen used: suspension of E.B.s from patient's gland flocculated with antiserum twice over. Strength of original gland suspension, 1:100,000; sent to Chile by aeroplane by Dr. Maxwell Chance on March 4, 1937.)