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OSTEOMYELITIS OF THE SPINE

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A study of a series of 82 cases of pyogenic osteomyelitis of the spine has shown that the clinical features at the initial stage of the disease often present such a varied picture that the correct diagnosis may easily be overlooked for a long time. Once radiographic changes are demonstrated, the primary consideration in differential diagnosis is tuberculous spondylitis. Bacteriological verification by needle biopsy or surgical exploration is recommended in order to institute an adequate antibiotic therapy. Surgical evacuation is advocated in cases with extensive vertebral destruction. The majority of patients recovered within 1 year from the onset of illness. In slightly more than half of the cases the spinal lesions healed with spontaneous interbody fusion. This tendency was most pronounced in cases of cervical and upper thoracic involvement. No deaths occurred as a result of the spinal disease.

Key words: clinical course; osteomyelitis of the spine; prognosis; symptoms; treatment

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Up to a few decades ago, tuberculous spondylitis accounted for the majority of the inflammatory conditions involving the spine diagnosed in Sweden. During recent years the picture has changed and tuberculous spondylitis has become relatively uncommon, whereas osteomyelitis of septic origin has increased in frequency (Figure 1). The symptomatology of pyogenic osteomyelitis of the spine has been described by several earlier authors (Wilensky 1929, Kulowski 1936, Guri 1946, Alvik 1951, Garcia & Grantham 1960, Robinson & Lessof 1961, Ambrose et al. 1966, Paus 1973, among others). It is obvious that the condition presents diagnostic pitfalls and is difficult to differentiate from other diseases, especially tuberculous spondylitis. Whereas earlier studies of pyogenic osteomyelitis of the spine have mainly dealt with the symptomatology and diagnostic features of the disease, relatively little interest has been devoted to the clinical course and late results.

The present study was undertaken to illustrate diagnostic problems on the basis of a clinical material and to present an account of the clinical course and prognosis in pyogenic osteomyelitis of the spine.

PATIENTS

The clinical material comprises 82 cases of haematogenous pyogenic osteomyelitis of the

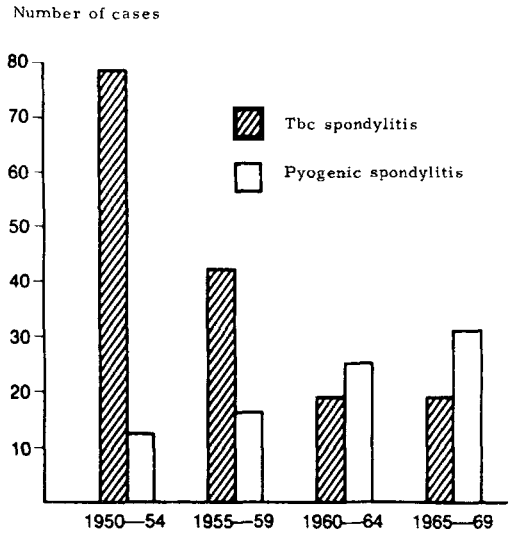

Figure 1. Distribution of cases admitted to the Orthopaedic Department, St. Göran's Hospital, and diagnosed as tuberculous spondylitis or pyogenic osteomyelitis of the spine during the period 1950–1969.

spine treated at the Orthopaedic Department of St. Göran's Hospital, Stockholm, during the years 1950–1970. Cases of postoperative vertebral osteomyelitis following disc surgery are not included. The series consisted of 52 men and 31 women. As seen in Table 1, the male predominance is due to an accumulation of cases in the age groups over 40 years.

Level of spinal involvement

In eight cases the osteomyelitic changes were located in the cervical spine. In the remainder of the series, the distribution of thoracic and lumbar involvement was largely the same (Table 2). In the vast majority of cases (75 patients) two adjacent vertebral bodies were affected. In three cases changes were present in only one vertebral body, in two cases in three, and in two cases in four adjacent vertebral bodies. In no case was there any involvement of the arches or spinous processes.

Table 1. Age and sex distribution.

Age	Men	Women	Total
0–10	1	1	2
11–20	4	7	11
21–30	4	5	9
31–40	4	4	8
41–50	7	3	10
51–60	12	2	14
61–70	13	7	20
71–80	4	2	6
over 80	2	0	2
Total	51	31	82

Table 2. Site of vertebral osteomyelitis.

Level of spinal involvement	Number of cases
Cervical	8
Thoracic	32
Thoracolumbar	6
Lumbar	27
Lumbosacral	8
Thoracic and lumbar	1
Total	82

Primary focus

A probable source of bacterial infection could be identified in 33 cases. In 19 of them symptoms developed as a direct sequel to a urinary tract infection (Table 3). Forty-nine patients were unable to report any previous infection likely to have a connection with their spinal symptoms.

The interval between the primary infection and the onset of spinal symptoms ranged from 1 week to 3 months, but in the vast majority of cases the interval was between 2 and 3 weeks.

Ten patients (12 per cent) in the total series had diabetes mellitus.

CLINICAL FEATURES

In all but seven cases the onset of illness was acute or subacute and fever and pain were the two symptoms dominating the initial stage. Ten of the patients were hospitalized in an isolation unit with a diagnosis of obscure pyrexia. Since back pain in these cases was overshadowed by

Table 3. Primary focus.

Urinary tract infection	19
Respiratory tract infection	8
Skin infection	4
Cholecystitis	2
Unknown	49
Total	82

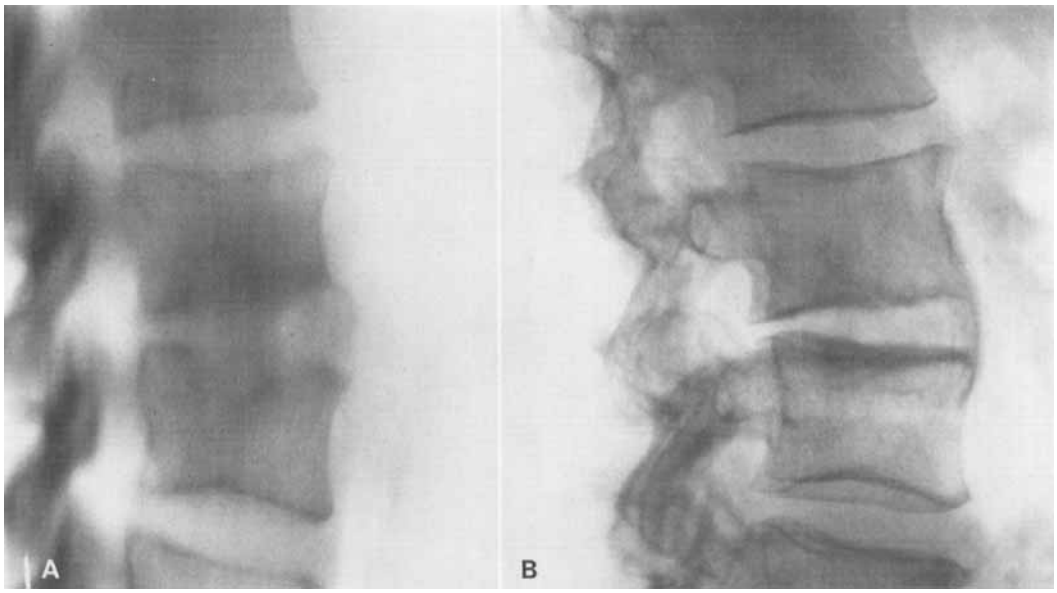

Figure 2. Radiograms of a male, 58 years of age. A. Tomogram 2.5 months after onset shows narrowing of the space between L2 and L3 and destruction in these vertebral bodies. No gibbus can be seen. A thin layer of new bone is visible anteriorly. B. Two years later the bone structure is partly normalized. Anteriorly there is a bridge of bone between L2 and L3.

the fever and general systemic reaction, the correct diagnosis was frequently considerably delayed.

Most of the patients, however, had a severe, dull backache during the first 1 or 2 months, which was aggravated by movement. Segmentally radiating pain was very common and frequently led to an erroneous initial diagnosis. Two of the cases of cervical osteomyelitis, for instance, were diagnosed as myocardial infarctions and admitted to an internal medical unit. In cases of osteomyelitis involving the thoracic or lumbar spine, abdominal pains frequently dominated. Eleven patients were referred to a general surgical unit as acute abdominal cases and in three cases laparotomy was performed (in one case for suspected ileus and in two cases for suspected appendicitis). In cases of osteomyelitis involving the lower lumbar spine, sciatic pains in one or both legs were not uncommon.

Objective findings at the acute stage were muscle spasm and rigidity in the affected spinal region. Distinct percussion tenderness over the spinous processes of the affected vertebrae was an almost constant finding. Sciatic pains were not at any time associated with signs of neurological deficit. Four patients (5 per cent) in the total series developed paraplegia, after an interval of 2, 4, 5 and 6 weeks, respectively, from the onset of illness.

Laboratory findings

In most cases ESR was strongly elevated during the first months of the disease. In 31 cases the highest recorded value exceeded 100 mm/h, and in 62 cases 50 mm/h.

The antistaphylolysin titre was determined in 76 cases and was increased (more than 2.0 IE) in 36 patients. In 12 cases peak values of more than 16.0 IE were recorded.

Radiographic findings

The earliest radiographic changes, in the majority of cases seen from 2 to 8 weeks after onset, were paravertebral soft tissue swelling, narrowing of the disc space and superficial destruction of the end plates of adjacent vertebral bodies (Figures 2 and 3).

DIAGNOSIS

The diagnosis was, in 20 cases, confirmed by bacterial culture of specimens obtained either directly from the spinal focus of infection or from a paravertebral abscess. In ten cases the specimen was obtained by needle biopsy and in the remaining ten cases at operation. In most of these cases additional histological examination was performed and showed a non-specific inflammation.

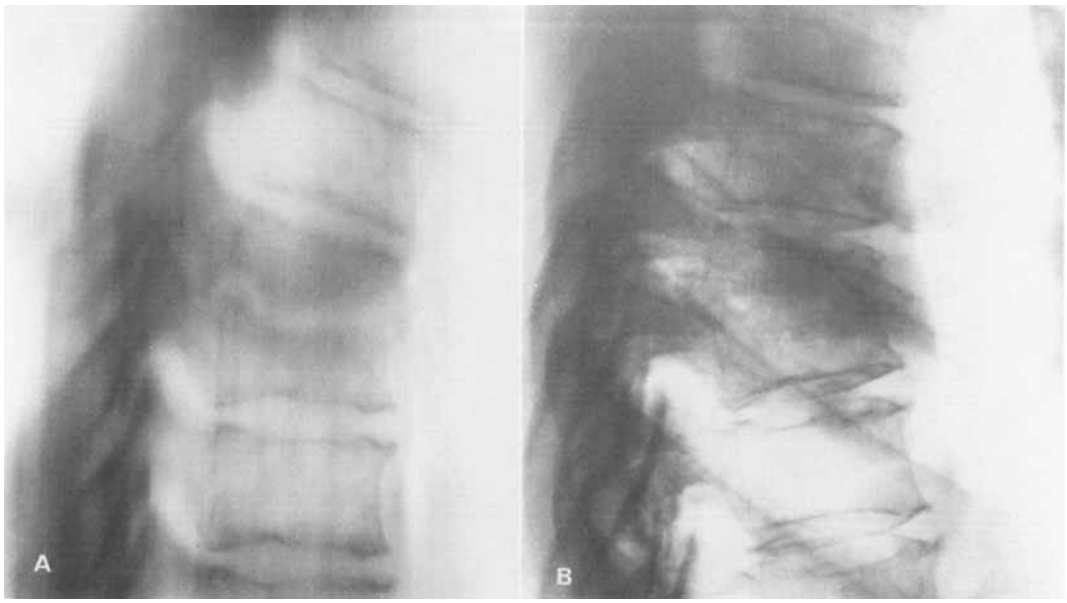

Figure 3. Radiograms of a male, 42 years of age. A. Tomogram 2 months after onset shows extensive destruction in the adjacent parts of Th7 and Th8 and a slight gibbus. B. Seven months after onset the intervertebral space is bridged by bone, but the bone structure is still irregular.

In another 17 cases the diagnosis was confirmed only by histological findings, after routine bacterial culture, tubercular culture and guinea-pig tests had proved negative.

In slightly more than half of the cases (45 patients) histological proof and bacterial culture from the osteomyelitis region was lacking, and in these cases diagnosis was based on the clinical features and the appearance of the radiographic changes. Four of the patients in this group had a positive blood culture, and in another five cases, which in all likelihood were secondary to a urinary tract infection, a positive urine culture was noted in the records.

Needle biopsy was done in 41 cases (4 cervical, 18 thoracic and 19 lumbar) and yielded positive results in 20 cases (positive culture and/or histological findings).

Bacteriology

The infecting organism could be identified in 24 cases (Table 4). All but two of the 18 patients with spondylitis caused by *Staphylococcus aureus* had an increased antistaphylolysin titre. The primary source of infection in these cases was the urinary tract in four patients, the respiratory tract in four patients, a skin infection in three patients, and cholecystitis with a subphrenic abscess in one case. In the remaining six cases no primary focus could be established.

Table 4. Causative organism.

Staphylococcus aureus	18
Staphylococcus albus	1
Escherichia coli	4
Proteus	1
Total	24

TREATMENT

Surgical exploration was performed in 20 cases. In 15 cases osteomyelitis involved the thoracic spine and exposure was made by costotransversectomy in all of these cases. In the other five cases the lumbar spine was the site of the osteomyelitic lesion, and exposure was made retroperitoneally. The purpose of this operation was twofold. In the first place it permitted the diagnosis to be verified in cases with inconclusive clinical and radiographic findings and provided the material for bacterial culture to guide the selection of the appropriate antibiotics for continued treatment. Secondly, in cases with extensive destruction and suspected paravertebral abscesses, surgery was undertaken with the aim of speeding up healing by removing infectious tissue. In these cases, a tuberculous origin was often suspected. In two cases the in-

dication for surgery was paraplegia developing as a sequel to osteomyelitis in the thoracic region.

The time between the onset of illness and operation varied between 6 weeks and 2 years. In ten cases operation was performed within the first 4 months and in all but two cases within 9 months of onset. In eight of the operated cases, the spinal lesion was found to be at the healing stage and the operation was considered to have had diagnostic value only. In 12 cases such a large amount of infectious tissue was removed that this could reasonably be considered to have sped up the healing process. Abscesses of varying size, although never larger than a walnut, were found in only six of the 20 operated patients. The remainder had oedema or merely a diffuse swelling of the paravertebral tissues.

Posterior fusion was performed in two cases. One of these patients had an atlanto-axial osteomyelitis resulting in complete destruction of the odontoid process and instability between the first and second cervical vertebrae. A detailed report of this case has been published earlier (Ahlbäck & Collert 1970). In the second case, posterior fusion at the level of the eleventh and twelfth thoracic vertebrae was prompted by an unusually protracted course with intractible pain.

No serious postoperative complications occurred.

Antibiotic treatment

Fifty-three patients were treated with antibiotics over a continuous period of more than 1 week. Eighteen of these patients were treated for a period of 1 to 3 months, and 25 patients for more than 3 months. In 29 cases no antibiotic treatment was felt to be necessary.

Immobilization

The duration of bedrest has been dictated by the patient's subjective symptoms, even though some caution with respect to mobilization has been observed in cases with extensive vertebral destruction. A plaster bed was used in only eight cases.

CLINICAL COURSE

In about one-third of the patients with an acute or subacute onset, general malaise and pain were so pronounced during the first 1 or 2 months that they were largely confined to bed. In the remainder of the series the acute stage was of shorter duration, sometimes less than 1 week. This was followed by a gradual improvement, with considerable individual variations in the rate of improvement. In assessing the activity of the osteomyelitic process, ESR was used as a guide and on the whole this also reflected the patients' subjective symptoms. Occasional brief periods of exacerbation, during which the patients' complaints were aggravated and a slightly elevated temperature was also noted in some cases, were not uncommon. Peak ESR and ASTA readings were usually recorded 1 to 2 months after onset.

In those patients (64 cases) in which the interval between the onset of illness and normalization of ESR readings (< 15 mm/h) could be determined, a median value of 3.5 months (range 2–6 months) was found for cervical, 6 months (range 1–12 months) for thoracic, and 7 months (range 1–30 months) for lumbar osteomyelitis.

No appreciable difference was noted in the length of the clinical course between patients with increased antistaphylolysin titre and the remainder of the series. Peak ESR readings recorded in cases of "Staphylococcus osteomyelitis" were significantly higher than in the remainder of the series, however.

Of the two patients with total paraplegia, in whom operation was performed, one case made a complete recovery within 9 months of operation. The other patient, who had a history of total paraplegia for 3 months prior to operation, improved postoperatively but 2 years later still had a partial spastic paraparesis. Two other patients, who were partially paraplegic, were treated conservatively and made a recovery 5 and 20 months after onset, respectively.

RESULTS

Sixty-five patients with a follow-up period of more than 2 years (average 6 years) were available for follow-up examination. Of the remainder of the series, eight patients had died and nine could not be traced.

Subjective symptoms. Sixty-one patients were symptom-free or had symptoms of such a mild nature that their activities were not appreciably restricted.

Two patients reported backache of such severity as to occasion periodical sick-leave.

One patient had been granted a disability pension because of his back symptoms and one patient still had a partial spastic paraparesis.

Three patients had had suspected recurrences with an acute onset of back pain, fever and ESR over 100 mm/h. Radiographic examination of the back failed to demonstrate any destructive process going on in the skeleton.

Objective findings. Clinical examination of the back showed a marked gibbus at the level of osteomyelitic involvement in two cases.

Radiographic findings. The radiographic evidence showed all spinal lesions to be healed at follow-up examination. In 33 of the 56 cases included in this follow-up examination, total or partial bony fusion between the involved vertebrae was noted. All six of the cervical lesions and 22 of the 29 thoracic lesions had healed by interbody fusion, but this was found in only five of the 21 cases of lumbar involvement. When interbody fusion had not occurred, the usual finding was a narrowed disc space with some irregularity in the end plates, but with normal bone structure (Figures 2 and 3).

DISCUSSION

The clinical features of pyogenic vertebral osteomyelitis in its initial stage may present a highly varied picture. Referred pain is common and easily tends to lead to an erroneous diagnosis, as evidenced by the present series. This risk appears to be greatest when the disease involves the lower region of the thoracic spine or the upper region of the lumbar spine. At these levels the clinical picture is often dominated by abdominal pains which may suggest an acute abdominal condition. In urosepsis complicated by vertebral osteomyelitis the symptoms—pain and fever—may for a long time be masked by or be attributed to the primary infection. Spinal changes may be seen as early as 2 to 3 weeks after the onset of symptoms, but in other cases 2 or 3 months may pass before any changes can be demonstrated. In the present series the correct diagnosis was considerably delayed in several cases by negative radiographs during the first few months.

Once radiographic changes have been demonstrated, the primary consideration in *differential diagnosis* is tuberculous spondylitis. That pyogenic osteomyelitis of the spine is frequently erroneously interpreted as being of tuberculous origin is demonstrated by the present series, in which no less than 28 of the 82 patients were referred to this department with a diagnosis of tuberculous spondylitis. In 11 of these cases antituberculous chemotherapy had been initiated. The differential diagnosis may sometimes present difficulties, but in our experience many of the clinical and radiographic findings in pyogenic osteomyelitis of the spine are sufficiently characteristic for the correct diagnosis to be established in the majority of cases once radiographic changes can be detected (Ahlbäck et al. 1969, 1973).

Malignancy was suspected in a few cases, which radiologically were characterized by a destructive process wholly or predominantly confined to one single vertebra. As a rule, however, differential diagnosis in these cases has presented little difficulty.

In contrast to tuberculous spondylitis, reports on *surgical treatment* for pyogenic osteomyelitis of the spine are very scarce. Most authors consider immobilization and antibiotics sufficient treatment (Garcia & Grantham 1960, Robinson & Lessof 1961, Pollack et al. 1964, Weber 1965, Ambrose et al. 1966, Griffiths & Jones 1971). Riskó et al. (1962), on the other hand, advocate radical evacuation in all cases to ensure reliable healing. Even though the end result is the same, we feel that evacuation of foci of infection and abscesses may speed up healing in cases with radiographic evidence of extensive destruction and marked paravertebral swelling. Our experience

suggests that such operations will be of greatest value when performed within 3 to 4 months of onset.

The incidence of *paraplegia* as a complication to pyogenic osteomyelitis of the spine varied between 4.5 and 13 per cent in reports published during recent years (Alvik 1951, Weber 1965). In our series the incidence was 5 per cent. Conservative management is advocated by most authors also in the treatment of this complication and reports on the results of surgical treatment are on the whole lacking. From our experience of surgical treatment of paraplegia secondary to tuberculous spondylitis, we feel that anterior decompression by thoracotomy, or in some cases anterolateral decompression by costotransversectomy, is indicated in paraplegic cases (Felländer 1975). Even though conservative treatment may also lead to the desired result, anterior or anterolateral decompression is in all likelihood a quicker and more reliable way of achieving restitution.

The effect of *antibiotic treatment* is difficult to assess. However, we may reasonably assume that early and adequate drug therapy will prevent or minimize progress of the destructive changes in the affected vertebrae and thus promote a faster recovery. This naturally presupposes that a bacteriological diagnosis is obtained at an early stage of the disease. Our experience indicates that a consistent course of treatment with an appropriate antibiotic until normal ESR readings are obtained, or for at least 3 months, is to be preferred to varying the drug if no immediate response is effected.

The clinical course and late results have been treated very summarily and incompletely in earlier reports on pyogenic osteomyelitis of the spine. The high mortality rate recorded in the preantibiotic era (Kulowski 1936) has in more recent studies been reduced to less than 10 per cent (Garcia & Grantham 1960, Ambrose et al. 1966). In our series no deaths resulted from the disease. With regard to the duration of illness and clinical course, Garcia & Grantham (1960) report that the average time required to return to work in their series was 12 months from onset, and that spontaneous interbody fusion was the rule. Robinson & Lessof (1961) noted that there is, in some cases at least, a tendency to spontaneous recovery, but the disease may remain chronic or recur after months or years. Weber (1965) found recurrences in 13 per cent of his cases. In our series the clinical course was fairly similar in the majority of cases with an apparently strong tendency to spontaneous healing. A noteworthy finding is that the period of illness tended to be shorter and interbody fusion more common in cases of cervical involvement than when other levels were involved. The risk of recurrence would seem to be small. In our series suspected recurrences were noted in three cases (4 per cent).

Earlier authors (Felländer & Lindberg 1966, Defiore et al. 1970) have shown that scintimetry may be of value in determining whether or not a spondylitic process is active. In our series the method was adopted for that purpose in a limited number of cases, but it cannot be used as a diagnostic tool to differentiate pyogenic osteomyelitis of the spine from tuberculous disease or cancer.

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