ATYPICAL FORMS OF SPINAL TUBERCULOSIS

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Thirteen patients, aged 7 to 45 years, have been treated for atypical forms of spinal tuberculosis at the Neurological Centres at Benghazi and Lahore. All presented with signs and symptoms of compression of the spinal cord or cauda equina, ranging from paraesthesiae and increasing weakness to paraplegia and loss of sphincter control. None of them showed visible or palpable spinal deformity nor the typical radiographic appearance of destruction of the intervertebral disc and the two adjoining vertebral bodies. These atypical cases fell into two well-defined groups: those with involvement of the neural arch only, with associated intraspinal cold abscesses, and those with involvement of a single vertebral body, resulting in its collapse and a radiographic appearance similar to that in secondary carcinoma of the vertebral body.

The correct treatment in these two groups was diametrically opposed. Tuberculous disease of the neural arch was best treated by laminectomy; concertina collapse of a single vertebral body required costo-transversectomy and resection of the transverse process, the pedicle, and the portion of the vertebral body that was encroaching on the spinal canal.

Spinal tuberculosis has become rare in the West but it is still prevalent in the densely populated parts of Asia and Africa, where it is one of the commonest forms of skeletal tuberculosis. The classical picture of disease of two vertebrae with destruction of the intervening intervertebral disc and a paravertebral or psoas abscess is readily recognised and treated. But atypical forms affecting the neural arch only with intraspinal cold abscesses, and disease of a single vertebra with concertina collapse of the vertebral body without involvement of the intervertebral discs, are not well recognised and often misdiagnosed and mistreated. Thirteen such atypical cases are presented and their appropriate treatment suggested.

In the majority of cases, treatment of tuberculosis of the spine falls within the realm of the orthopaedic surgeon. However, when there is paraparesis or paraplegia, which occurs in approximately one-fifth of the patients with vertebral tuberculosis, neurosurgical management is required. As the present work was carried out in the neurosurgical centres in Benghazi and Lahore, all the patients had evidence of compression of the spinal cord or cauda equina.

TUBERCULOSIS OF THE NEURAL ARCH

The author is unaware of any report of the tuberculous process affecting the neural arch only with complete sparing of the vertebral bodies and the intervertebral disc. Five such cases have been treated between 1969 and 1979.

All five patients were referred to the neurosurgical centre with signs and symptoms of compression of the spinal cord or a lesion of the nerve root. There were three male patients and two female and their ages ranged from 7 to 35 years. Backache had been present in only three patients, occurring from six weeks to two years before the onset of radicular pain and neurological deficit. Two were still able to walk: one had gross weakness of the dorsiflexors and plantarflexors of both feet, with sensory loss in the distribution of the fourth and fifth lumbar and the first sacral nerves, and absent ankle jerks, but he was still continent; the other had bilateral weakness of the legs which was most evident in the dorsiflexors and plantarflexors of the feet and in the peroneal muscle groups, had delay in urination and episodic incontinence. The remaining three patients were bedridden with paraplegia and loss of sphincter control and had definite levels of sensory deficit; paraplegia had been present for two, six and 18 weeks respectively.

All five patients were afebrile, and none showed any visible or palpable deformity of the back. Local tenderness, however, was present in four and corresponded with the level of the disease. Radiographs of the spine showed no bony abnormality. Myelograms showed complete block of the spinal canal, in the lumbar region in two patients and in the thoracic region in three. In four the myelographic block suggested extradural compression, the meninges and spinal cord being compressed in diameter; in one the block had a crescentic edge suggesting a subdural block. There was no evidence of involvement of adjacent vertebral bodies or intervertebral discs in any patient.

All five patients had a laminectomy performed at the level of the myelographic block. In four, both laminae of one or more vertebrae were found to be...
completely destroyed and replaced by tuberculous granulation tissue, so that there was a real danger of damaging the cord while stripping back the paravertebral muscles. Four patients had associated extradural abscesses compressing the meninges and spinal cord and causing a complete block: the pus of three of these abscesses was greenish yellow while that of the fourth was whiter and had the consistency of toothpaste; *Mycobacterium tuberculosis* could be isolated from three of them while the fourth was reported to be sterile. However, biopsy of the granulation tissue replacing the laminae showed typical Langhans' giant cells, epithelioid cells and round cells in all four (Fig. 1). One patient had a subdural abscess which was sterile, but the laminae overlying it were found to be softened and weakened by permeation with typical tuberculous granulation tissue. In all patients, the compressing granulation tissue was removed, the abscesses were evacuated completely and antituberculous drugs—a combination of streptomycin, isoniazid and paraaminosalicylic acid—were given for a minimum period of 12 months. This resulted in rapid improvement in their neurological signs and a satisfactory recovery.

**ILLUSTRATIVE CASE REPORTS**

**Case 1.** This nine-year-old boy presented with a two-month history of backache radiating down both legs. Straight leg raising was restricted to 30 degrees on each side. There was hypoesthesia in the distribution of the fourth and fifth lumbar and the first sacral nerves, bilateral weakness of plantarflexors and dorsiflexors, and bilateral loss of ankle jerks. No sphincter disturbance was present. There was stiffness and restricted movement of the spine. There was no visible or palpable deformity but tenderness could be elicited over the spinous processes of the fourth and fifth lumbar vertebrae. A spinal radiograph did not reveal any bony abnormality. Lumbar puncture for myelography in the interspace between the third and fourth lumbar vertebrae revealed greenish yellow pus instead of CSF. A fresh needle was introduced between the second and third lumbar vertebrae and this revealed clear CSF under normal pressure. A myelogram showed a complete block at the level of the third and fourth vertebrae with a crescentic lower edge suggesting an intradural block (Figs 2 and 3). Laminectomy of the third, fourth and fifth lumbar vertebrae was performed. Both the laminae of the fourth lumbar vertebra were found to be completely softened and at places replaced by granulation tissue. The dura was opened and a large subdural abscess containing greenish yellow pus was evacuated completely. A rubber drain was left at the site for three days. Vigorous antituberculous therapy was then given. Biopsy of the softened bone from the eroded laminae of the fourth lumbar vertebra showed typical tuberculous granulation tissue consisting of Langhans' giant cells, epithelioid cells and round cells (Fig. 1). Pus from the subdural abscess was reported to be sterile and tubercle bacilli could not be isolated from it. The patient made a satisfactory recovery with rapid improvement in the neurological signs in his legs.

**Fig. 1**
Typical Langhans' giant cells, epithelioid cells and round cells.

**Fig. 2**
Anteroposterior and lateral myelograms (standing) showing a complete block at L3–4 due to a tubercular subdural abscess.
Case 2. This 35-year-old man presented with a history of backache with radiation down both legs and numbness on the dorsal surfaces of both feet. Both ankle jerks were absent and straight leg raising was restricted on the right. There was gross weakness of dorsiflexors and plantarflexors of the right foot but only mild weakness of plantarflexors on the left. Local tenderness was present over the back of the sacrum and the spinous process of the fifth lumbar vertebra. Radiographs of the spine were completely normal. The myelogram showed a block at the level of the fifth lumbar and first sacral vertebrae caused by extradural compression. A rounded extradural mass, more to the right side, appeared to be constricting and compressing the meninges and cauda equina at this level. Operation revealed that tuberculous granulation tissue had completely replaced and thereby weakened the laminae of the fifth lumbar and first sacral vertebrae. A large, encapsulated extradural abscess, extending into the sacral canal, was drained and tubercle bacilli were isolated from the pus. Recovery was satisfactory.

SINGLE VERTEBRA DISEASE

This name has been given to a state which occurs when a single vertebral body, weakened by permeation with granulation tissue, collapses. As it does so, it protrudes radially and may cause paraplegia. This can be confused with secondary carcinoma of the vertebral body which has a similar radiographic appearance. Unlike the classical picture of spinal tuberculosis, the intervertebral disc and the adjoining vertebrae are not involved.

Between 1969 and 1979 eight patients were operated on for compression of the spinal cord or cauda equina. Before operation the diagnosis in five of them was secondary carcinoma of a vertebral body while in three tuberculosis was suspected despite atypical radiographic appearances because there was evidence of associated pulmonary tuberculosis. In three the standard laminectomy was carried out, while the remaining five were decompressed via the anterolateral approach. Rapid neurological improvement was obtained by decompression whereas laminectomy caused deterioration and paraparesis worsened into paraplegia. The vertebrae involved in these eight patients are shown in Table I.

At operation the spinal cord was found to be compressed and kinked from the front. The compressing agents were granulation tissue, small fragments of bone and slough, and there was an associated intraspinal extradural abscess in five patients. Diagnosis was confirmed by biopsy or by the demonstration of Mycobacterium tuberculosis in the pus or granulation tissue.

Table I. Single vertebra disease in eight patients

<table>
<thead>
<tr>
<th>Vertebra involved</th>
<th>Number of patients</th>
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<tbody>
<tr>
<td>Sixth thoracic</td>
<td>2</td>
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<tr>
<td>Seventh thoracic</td>
<td>1</td>
</tr>
<tr>
<td>Ninth thoracic</td>
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<td>Eleventh thoracic</td>
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<tr>
<td>Twelfth thoracic</td>
<td>1</td>
</tr>
<tr>
<td>First lumbar</td>
<td>2</td>
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ILLUSTRATIVE CASE REPORTS

Case 3. This 26-year-old woman was admitted with a three-month history of increasing weakness of both legs and intermittent incontinence of urine. She had hypoesthesia up to the sixth thoracic dermatome, spasticity of both legs and exaggerated tendon jerks. Babinski's sign was positive and she had bilateral ankle clonus. Spinal radiographs showed collapse of the body of the sixth thoracic vertebra (Figs 4 and 5). No abnormality of adjacent intervertebral discs or vertebrae could be detected and there was no evidence of a paravertebral abscess. The myelogram showed a complete block at the level of the collapsed vertebra (Fig. 6) and a diagnosis of secondary carcinoma was made. Laminectomy was carried out, and granulation tissue, pus and debris were found to be compressing and distorting the cord from the front and pushing it posteriorly. Granulation tissue was removed and thick toothpaste-like pus was drained after gentle retraction of the cord, but satisfactory decompression from the anterior compressive agents was not found to be possible without...
undue retraction of the cord. After operation her paraparesis became dense and she became incontinent. She was re-operated 24 hours later through an anterolateral approach; resection was carried out of the transverse process, the pedicle and the portion of the vertebral body that was encroaching on the spinal canal; granulation tissue and thick pus were removed together with small fragments of bone which were compressing the cord from the front. Antituberculous therapy was started but she remained paraplegic and bedridden for many months. Recovery was very slow and incomplete. Case 4. This 17-year-old girl was admitted with increasing paraparesis and incontinence of six weeks' duration. A radiograph showed a collapsed body of the ninth thoracic vertebra and a myelogram revealed a complete block at that level. Adjacent intervertebral discs and vertebrae were normal. She had a history and radiographic evidence of pulmonary tuberculosis. Through an anterolateral approach a large quantity of granulation tissue was removed and an extradural abscess was evacuated. Recovery was uneventful. Weakness and incontinence improved rapidly. She could walk with help after three months and has continued to improve for two years.

**DISCUSSION**

Spinal tuberculosis in its classical form of “two-vertebra disease with the destruction of the intervening intervertebral disc” is easily recognised and readily treated; but the two atypical forms of spinal tuberculosis described here are relatively uncommon. Perhaps for this reason there is delay in diagnosis and irreversible neurological sequelae in a high percentage of cases. A search of the literature was made to find an explanation for this unusual distribution of tuberculous disease, where it was confined to the neural arch only or to a single vertebral body. Current knowledge on pathogenesis of spinal tuberculosis and pertinent experimental work point towards certain interesting facts which appear to offer a clue.

In pyogenic osteomyelitis the spine is involved in under five per cent of cases while in tuberculosis it is involved in 58.7 per cent (Kulowski 1936). If pyogenic osteomyelitis is an arterial blood-borne disease, can *Mycobacterium tuberculosis* spread by the same route and give such a marked difference in percentage of involvement? This could be explained if the tubercle bacillus and the vertebra had some special affinity for each other. But all attempts to produce spinal tuberculosis in experimental animals by injecting *Mycobacterium tuberculosis* locally into the vertebrae and into the left ventricle of the heart, as described by Blacklock (1957), failed to produce any spinal disease. The explanation suggested is that a different pathway of spread, either venous or lymphatic, might occur in spinal tuberculosis.

Henriques (1958) showed that osteomyelitis complicating infections after urological operations usually occurred in the spine. He concluded that these infections travelled from the primary focus to the spine by way of the venous pathway suggested by Batson (1940). Although the nature of the organisms varied greatly, they settled mainly in the spine.

In a series of animal experiments in which organs in the abdomen and pelvis were injected with *Mycobacterium tuberculosis*, it was possible to produce a primary infection in the injected organ, usually the kidney, and a secondary lesion in the spine. By making sections of these animals it was possible to trace the infection from the kidney to the spine via the fourth venous plexus: it was found to penetrate the spinal canal and pass upwards along the vertebral veins and could produce lesions in vertebrae at a higher level.

The posterior external venous plexuses of the vertebral veins are placed on the posterior surfaces of the laminae and around the spinous, transverse and articular processes. They anastomose freely with the other vertebral venous plexuses and constitute the final pathway for the infection to reach the neural arch in the atypical form of spinal tuberculosis in which it is solely involved. A good anatomical description of these vertebral venous plexuses in man is given by Clemens (1961), and the physiological significance has been described by Herlihy (1947, 1948), Batson (1957) and Eckenhoff (1966). In the second atypical form, the single vertebra disease, the intervertebral disc does not become involved as a primary focus as it is an avascular structure. The textbook description that the narrowing of the intervertebral disc is an early sign of spinal tuberculosis is true, but the deduction that “therefore the intervertebral disc is involved primarily in the disease” is not so. What takes place is that the vertebral bodies on either side of the disc are infiltrated with granulation tissue and lose their blood supply, and the disc loses its nutrition and becomes narrow. In the single vertebra disease described here, nutrition of the disc continues from the side of the healthy vertebra and hence the disc stays normal.

**REFERENCES**


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