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# Neural arch tuberculosis: a morbid disease

## Radiographic and computed tomographic findings

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**Summary.** *We have reviewed the clinical features, together with the radiographs and computerised tomography, in 9 patients with tuberculosis of the vertebral body and neural arch. All presented with paraparesis or paraplegia. The morbidity associated with this disease is so serious that it is essential to have an accurate means of evaluating the lesion as early as possible. Routine radiographs can only indicate the level of the disease and the loss of disc space, but cannot define the full extent of the lesion. Computed tomography shows details of the tuberculous involvement of the neural arch, as well as the vertebral body and spinal canal; the site and extent of the soft tissue lesions can also be seen. This is essential for evaluation of the neural arch involvement which will enable the clinician to select the appropriate treatment, and so prevent neurological complications.*

**Résumé.** *La pathologie associée à l'atteinte étendue de l'arc postérieur dans la tuberculose vertébrale de l'adulte rend nécessaire de disposer de moyens précis de détecter précocement cette lésion. Notre expérience et celle d'autres auteurs montre que cela est possible grâce à l'utilisation de la tomodensitométrie (TDM). Les radiographies ordinaires du rachis permettent de préciser le niveau des lésions et l'importance de la destruction discale, mais elles ne permettent pas d'estimer l'extension à la totalité de la vertèbre. Le traitement chirurgical, lorsqu'il est nécessaire, peut être différent en cas du tuberculose vertébrale postérieure de celui que réclament les lésions corporéales. La TDM est essentielle pour préciser cette atteinte en ce qui concerne les indications thérapeutiques.*

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## Introduction

The ubiquitous problem of tuberculosis has become more prevalent with the advent of the human immunodeficiency virus (HIV). In South Africa, tuberculosis is endemic in the Black community and the acquired immunodeficiency syndrome with related tuberculosis has assumed major proportions. Recently published reports suggest that neural arch involvement in tuberculosis could be associated with patients suffering from HIV [12, 13]; 3 cases have been described of selective neural arch disease, 2 of whom suffered paraparesis.

A well-penetrated coned view or tomographs are essential for the localisation of posterior spinal disease, but foci of less than 1 cm in diameter cannot usually be demonstrated in conventional radiographs [18].

The use of computerised tomography (CT) has been advocated in the evaluation of spinal tuberculosis [4, 9, 10, 21]. Previous reports have indicated that involvement of the neural arch is not uncommon in Coloured patients [3, 6], but the use of CT seems to have been limited to adults in African studies.

In view of the morbidity associated with neural arch tuberculosis [5, 11, 16], we undertook a retrospective review of patients investigated by both routine radiography and CT.

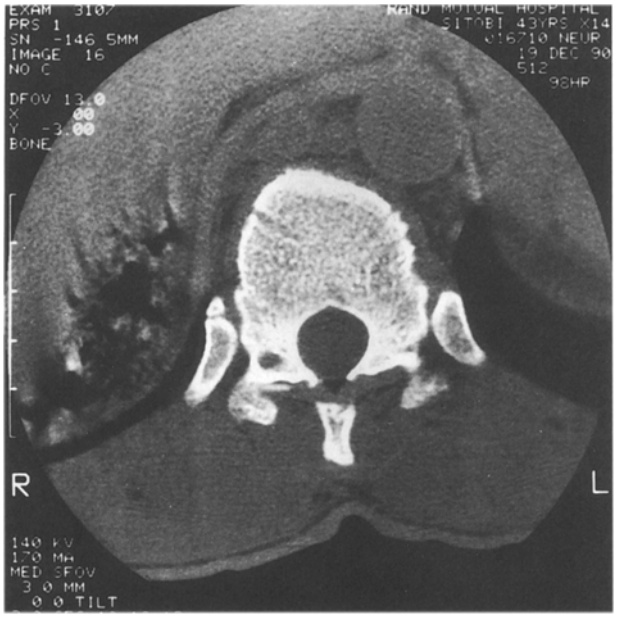


**Fig. 1.** An isolated tuberculous focus in the right pedicle demonstrated by CT. The patient presented with paraplegia and incontinence

## Patients and methods

Nine patients were reviewed; 8 had typical tuberculous disease of two vertebrae with destruction of the intervening disc space and a paravertebral psoas abscess. One patient had neural arch involvement only, the vertebral body being spared (Fig. 1). No patient was positive for HIV.

**Table 1.**

| | Age (years) | Sex | Site | Other sites of tuberculosis | Presentation |
|---|---|---|---|---|---|
| 1 | 34 | F | L3,4 | Nil | Root pain |
| 2 | 50 | F | L3,4 | Nil | Paraplegia |
| 3 | 60 | M | D1,2 | Nil | Paraplegia<br>Paraesthesia<br>Incontinence |
| 4 | 55 | M | D2,3,4 | Lt knee | Paraplegia |
| 5 | 32 | M | D8,9,10 | Pulmonary | Paraparesis |
| 6 | 43 | M | D11,12 | TB Meningitis | Paraparesis<br>Paraesthesia<br>Incontinence |
| 7 | 32 | M | L1,2 | Nil | Paraplegia |
| 8 | 54 | M | D8,9 | Nil | Paraplegia |
| 9 | 26 | M | D7,8,9 | Brain Tuberculomas | Paraplegia<br>Paraesthesia<br>Incontinence |

Extensive medical and neurological examination was carried out and the relevant findings, including the levels of involvement, are shown in Table 1.

Routine investigation included anteroposterior and lateral radiographs of the spinal column, with additional coned views of the area of interest. CT was performed with the General Electric 8000 model and comprised 10 mm thickness cuts at 10 mm intervals above and below the lesion, including the vertebral and soft tissue lesions. The study was concluded by taking 3 mm thickness cuts at 3 mm intervals over the area of the lesion viewed on a bony algorithm.

**Table 2.** Plain radiographic features

| | Deformity | Soft tissue | Disc space | Body | Neural arch |
|---|---|---|---|---|---|
| 1 | Severe kyphosis | No mass visible | Loss L3/4 | L3 focal anterior lysis + posterior destruction<br>L4 total destruction | L3 involvement<br>L4 poorly assessed |
| 2 | Scoliosis | No mass visible | Loss L3/4 | L3,4 bodies fused to form an amorphous mass | Poorly assessed |
| 3 | Scoliosis (mild) | Rt apical mass<br>Lt paratracheal mass | Loss D1/2 | D1 Rt hemivertebra destruction<br>D2 Rt hemivertebra destruction | D1 Bilateral pedicle erosion<br>D2 Rt pedicle erosion |
| 4 | Rt lateral wedging D2,3,4 | Bilateral paravertebral mass | Loss D2/3<br>Loss D3/4 | Lateral wedging Rt side D2,3,4 | D2 loss Rt pedicle<br>D3 loss both pedicles<br>D4 loss Rt pedicle |
| 5 | Kyphosis | Bilateral paraspinal mass, predominantly Rt side | Loss D8/9<br>Loss D9/10 | D9 wedging & fragmentation | D9 loss of pedicles bilaterally |
| 6 | Nil | Soft tissue paravertebral mass bilaterally D11,12 | Intact | Intact | Intact |
| 7 | Kyphosis | Paraspinal mass | Loss L1/2 | L1 vertebral body destruction<br>L2 vertebral body destruction | L1 Lt pedicle destroyed<br>L2 poorly assessed |
| 8 | Kyphosis | Paraspinal mass | Loss D8/9 | D8 irregular destruction inferiorly<br>D9 irregular destruction superiorly | Difficult to assess |
| 9 | Kyphosis | Large bilateral paraspinal mass | | D7 intact<br>D8 complete collapse<br>D9 intact | Difficult to assess |


**Fig. 2.** CT shows extensive destruction of the vertebral body, pedicle and lamina on both sides. There is paravertebral granulomatous calcification. The encroachment of the spinal canal is indicated by the *arrow*

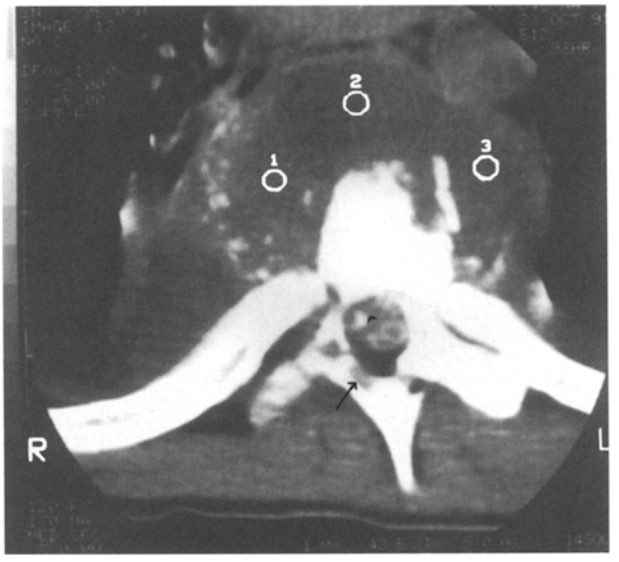


**Fig. 3.** CT after myelography shows low density lymph node enlargement (*1, 2, 3, rings*) and associated calcification, anterior vertebral body fragmentation and an *arrow-head* indicates encroachment of the spinal canal. The destruction of the right pedicle and lamina is indicated by an *arrow*

Postero-anterior radiographs of the chest were taken, and intravenous pyelography and voiding cysto-urethrograms carried out.

Histological confirmation of tuberculosis was obtained from material removed at operation in every case.

## Results

The mean age of the patients was 42.9 years; there were 2 females and 7 males. With a single exception, each patient presented with paraparesis (2 patients) or complete paraplegia (6 patients); 3 were incontinent. Associated pulmonary tuberculosis was present in one case; 2 patients had brain involvement with tuberculous meningitis or a tuberculoma. One man had tuberculous arthritis of his right knee and one woman present with root pain at a low lumbar level.

Marked shortcomings encountered on the plain radiographs included difficulty in detecting paravertebral granulation tissue or associated lymph node involvement, incomplete assessment of the extent of the lesion, particularly of the neural arch, because of the associated kyphosis, and inability to estimate encroachment of the spinal canal (Table 2).

CT allowed easy and accurate evaluation of the site and extent of the soft tissue lesions, as well as showing details of the tuberculous involvement of the vertebral body, neural arch and spinal canal (Fig. 2). Soft tissue calcification, undetected on plain radiographs, was obvious with CT, as was lymph node enlargement (Table 3) (Fig. 3).

## Discussion

This study included a significant number of Black patients who presented with neurological changes directly related to the progress of a tuberculous vertebral lesion. Delay in presentation allowed time for the granulomatous lesion to destroy the vertebra and encroach on the neural arch and spinal cord. Posterior vertebral tuberculosis is notorious for causing early spinal cord compression [11]. Published papers describing neural arch involvement in vertebral tuberculosis are listed in Table 4, and confirm its low incidence.

Early recognition of the extent of the disease is essential in order to plan the correct treatment. Conservative management with a good response is documented in slightly more than two-thirds of patients with Pott's paraplegia [15]. Operation is reserved for paraplegia deteriorating despite conservative treatment, paraplegia of rapid onset and severe paraplegia [8]. Anterolateral decompression is indicated for classical Pott's paraplegia with vertebral body involvement, whereas neural arch tuberculosis is one of the rare indications for laminectomy in tuberculous spinal disease. This operation allows confirmation of the diagnosis and the tuberculous focus can be removed [5, 8]. Extradural granulomata should be excised, as with

**Table 3.** C. T. features

| | Soft tissue | Vertebral body | Neural arch | Neural canal |
|---|---|---|---|---|
| 1 | Lt psoas abscess | L3 multifocal lytic areas + cortical break anteriorly | L3 Rt pedicle destroyed | L3 Soft tissue intrusion |
| | | L4 totally fragmented | L4 Lt pedicle destroyed | |
| | | L5 intact | L5 Lt pedicle destroyed | |
| 2 | Lt psoas abscess tracking into pelvis & Lt inguinal region | L3 large focal destruction Rt anteriorly with subligamentous soft tissue extension. L4 soft tissue subligamentous mass anteriorly + small local lytic areas. | L3 extension & destruction of Lt pedicle, lamina and transverse process. | L3 Soft tissue intrusion |
| 3 | C7-D2 Rt prevertebral lymphadenopathy & paravertebral mass replacing muscles. Rt apical necrotic lung mass | D1 fragmented | D1 destruction of Rt pedicle, lamina and transverse process, 1st rib, Lt pedicle and lamina | D1 Soft tissue intrusion Rt side |
| | | D2 fragmented | D2 lytic change + cortical destruction Rt pedicle & lamina | Intact |
| 4 | D1 Lt lymphadenopathy | D1 intact | D1 intact | |
| | D2/D3 Bilateral paraspinal mass | D2 fragmented | D2 Bilateral pedicle destruction | D2 Soft tissue intrusion anteriorly |
| | | D3 fragmented + major cortical lysis Lt anterior body | D3 Bilateral pedicle destruction | |
| | D4 Rt coalescent lymph node mass | D4 extensive lytic change | D4 Rt pedicle destruction | D4 Soft tissue intrusion with cord displacement |
| 5 | D8,9,10 Bilateral paraspinal mass predominantly Rt side | D8 peripheral circumscribed osteolysis with anterior subligamentous extension | D8 intact | D8 Rt sided extradural anterior cord encroachment |
| | | D9 complete fragmentation | D9 Bilateral pedicle destruction | D9 Large anterior and central soft tissue mass with bony fragments compressing cord |
| | | D10 intact | D10 intact | D10 Rt anterior extradural compression |
| 6 | D11/12 Retrocrural lymphadenopathy | D11 lytic lesion Rt cortex | D11 intact | No encroachment |
| | | D12 anterior subligamentous fragmentation | D12 Rt pedicle lytic | |
| 7 | Paraspinal mass L1,2 predominantly on Lt + calcific debris Lt | L1 multiple focal lytic areas (ant + post cortical rim destroyed) | L1 Lt pedicle fragmented & disrupted lamina trabeculae | L1 Soft tissue intrusion anteriorly |
| | | L2 marked fragmentation & subligamentous anterior fragmentation. | L2 Lt pedicle & lamina destroyed. Rt pedicle disorganized trabeculae | L2 Soft tissue intrusion anteriorly + bony fragments in canal |
| 8 | Bilateral paraspinal masses D8,9 | D8 inferior body fragmented | D8 Rt pedicle lytic | D8 Rt anterolateral soft tissue encroachment |
| | | D9 extensive fragmentation | D9 Rt pedicle destroyed | D9 extensive soft tissue encroachment virtually obliterating canal. |
| 9 | Bilateral paraspinal mass D7,8,9 | D5 Lt anterolateral erosion | | |
| | | D6 Lt anterolateral erosion | | |
| | Lt paraspinal mass D5,6 | D7 fragmentation anteriorly & subligamentous soft tissue mass with calcification | D7 Rt pedicle and lamina destroyed | D7 soft tissue encroachment anteriorly |
| | | D8 complete fragmentation | D8 bilateral neural arch destruction | |
| | | D9 fragmented | D9 intact | |

**Table 4.** Review of the literature

| Ref | Authors | Patients | Findings | Modalities |
|---|---|---|---|---|
| 3 | Bell and Cockshott 1971 Nigeria | 10 | Destruction of vertebral pedicle unilaterally or bilaterally (10) Destruction posterior aspect of vertebral body (7) | Plain film Tomograms |
| 16 | Naim-Ur-Rahman 1980 Pakistan | 13 | Neural arch only (5) Collapse of single vertebral body (8) | Plain film Myelogram Surgery |
| 9 | Hermann et al. 1983 USA | 4 | Erosion Lt pedicle & vertebral body (1) | CT |
| 21 | Whelan et al. 1983 USA | 9 | Pedicle (1) Posterior aspect vertebral body (1) | Plain films CT |
| 5 | Bubhulkar 1984 India | 228 | Neural arch only (22) | Coned plain films Laminectomy |
| 11 | Kumar 1985 India | 27 | Isolated posterior element (21) | Plain film Tomograms |
| 7 | Corea and Tamimi 1987 Saudi Arabia | 1 | Neural arch of atlas (1) | Plain film CT |
| 1 | Adendorff et al. 1987 Ciskei, South Africa | 261 | Neural arch (2) | Record review, Investigation method unspecified |
| 13 | Mallolas et al. 1988 Spain | 2 | Isolated neural arch (2) | Plain films Tomograms CT |
| 17 | Smith et al. 1988 USA | 4 | Neural arch & posterior vertebral body (3) | MRI |
| 20 | Travios and du Toit 1990 South Africa | 1 | Posterior & anterior involvement (1) | Plain films |
| 2 | Arthornthurasook & Chongpieboonpatana 1990 Thailand | 6 | Vertebral & posterior element involvement (6) | CT |
| 12 | Lin-Greenberg and Cholankel 1990 USA | 1 | Isolated neural arch (1) | CT |
| 14 | Monaghan et al. 1991 United Arab Emirates | 1 | Isolated neural arch (1) | CT |
| 10 | Jain et al. 1993 India | 30 | Posterior elements destroyed (11) | CT |
| 19 | Tibau et al. 1994 Spain | 4 | Isolated neural arch (4) | Plain films CT |

conservative treatment the granuloma will be converted into scar tissue which can maintain compression of the spinal cord [11]. Travlos and du Toit indicated that the rare simultaneous involvement of the anterior and posterior vertebral elements in spinal tuberculosis requires more than anterior spinal decompression, which on its own could result in total paraplegia [20]. These authors advocated posterior stabilisation preliminary to anterior vertebral body fusion in order to avoid the more ominous consequences of anterior fusion on its own. Arthornthurasook et al recommended combined anterior stabilisation and neural arch decompression in their management of vertebral body and neural arch involvement [2].

In view of the possible outcome, early assessment of the disease process in spinal tuberculosis warrants CT evaluation. Routine radiographs and linear tomography cannot provide a complete picture of the posterior neural elements because of the associated kyphosis. CT demonstrates that, after destruction of the vertebral body, the tuberculous process can extend anteriorly or posteriorly to encroach on the spinal canal, or to the paravertebral region producing a large abscess. As progressive vertebral tuberculosis has such a morbid outcome, the clinician should be offered the benefits of the detailed information which can be provided by CT early enough so that treatment can be planned before the spinal canal is involved.

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