BURST FRACTURES OF THE THORACOLUMBAR SPINE

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INTRODUCTION

A burst fracture occurs as the result of a compresive load, often with varying degrees of flexion, which causes part of the posterior vertebral body to be displaced backwards into the spinal canal with possible neural damage. The instability of this fracture has been recognised and both operative and nonoperative methods of stabilisation have been proposed (3, 4, 5, 8,12, 14).

We review a series of 31 burst fractures of the thoracolumbar junction and describe the characteristics of the patients, their injuries and their treatment.

METHODS AND MATERIALS

More than half of all (spinal) fractures occur in the thoracolumbar area (11). For the purposes of this study, this was defined as the eleventh thoracic to the 2nd lumbar vertebrae.

Clinical records and radiographs of patients with spinal injury who were admitted to the Department of Orthopedic Surgery, Singapore General Hospital from January 1982 to June 1987 were retrospectively reviewed. 31 fractures in 30 patients were classified as burst fractures.

RESULTS

1. Patient Characteristics

Twenty-five patients were men and five women; their ages ranged from 19 — 61 years with a mean age of 32 years. Table 1 shows the causes of their injuries. Seventeen patients also sustained other injuries.

Cause of Injury	Number of Patients
Fall from a height	21
Road traffic accident	5
Direct trauma	4
Total	30

Table 1: **PATIENTS BY CAUSE OF INJURY**

Ten patients were foreigners: 4 were Thai, 3 Korean, 1 Indonesian, 1 Indian and 1 West Malaysian.

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2. Distribution of Fractures

Seventeen fractures (55%) occurred at L1, 7 at T12 and the same number at L2. One patient had burst fractures of T12 and L1.

3. Fracture Radiology

The radiographs on admission of 20 fractures were examined. Table 2 shows them classified according to Denis (2).

Denis Type	No. of Fractures
A — Dual retropulsion	0
B — Classic Burst	17
C — Posteroinferior retropulsion	1
D — D1 — Burst-lateral translation	0
D2 — Burst-sagittal translation	0
E — Ulilateral Burst	2
Total	20

Table 2: **FRACTURES BY DENIS TAPE**

4. Neurological Status on Admission

Table 3 shows the distribution of patients according to Frankel Grade (6, 14) on admission. 23% sustained neurological deficits.

Frankel Grade	Number of patients
A	2
B	1
C	1
D	3
E	23
Total	30

Table 3: **PATIENTS BY NEUROLOGICAL STATUS**

5. Treatment

I. Nonoperative

Twenty-two patients were treated nonoperatively. They had all been graded Frankel **E** on admission and their mean kyphos angle on admission was 21 degrees. They were all treated with postural reduction and subsequent external immobilisation using a body brace.

Twenty out of 22 patients were followed up for a mean period of 10 months. There was no change in their neurological status and no significant change in the kyphos angle of 7 of these patients. Eight patients still experienced back pain when last seen; five did not. When last reviewed, 8 patients had returned to work and 2 had not.

II. Operative

Eight patients were treated operatively. On admission, 2 were Frankel A, 1 was Frankel B and another C, 3 were Frankel D and 1 was Frankel **E**. The mean kyphos angle of these patients was 28 degrees. All had immediate postural reduction and Table 4 shows the subsequent operative procedures performed.

Frankel Grade		First Operation		Second Operation	
Admission	Discharge	Days before Operation	Type of Operation	Days before Operation	Type of Operation
C	D	1	Posterior Stabilisation	6	Anterior Decompression
B	C	<1	Posterior Stabilisation	4	Anterior Decompression
E	E	10	Posterior Stabilisation	N.A.	N.A.
D	D	10	Anterior Decompression	3	Posterior Stabilisation
D	D	6	Posterior Stabilisation	N.A.	N.A.
A	A	3	Posterior Stabilisation	N.A.	N.A.
D	D	8	Anterior Decompression	N.A.	N.A.
A	A	<1	Meurig-Williams Plates	N.A.	N.A.

Table 4: **PATIENTS BY TYPE OF OPERATION**

Post-operatively, one patient suffered a pulmonary embolism that was treated conservativey. Another developed a hematoma that required reexploration and drainage. There was one case of jaundice and one symptomatic urinary tract infection. There were no wound infections.

Late complications included protrusion of a Harrington rod of a patient which required trimming of the rod and loosening of implant in a patient who had Meurig-Williams plates inserted, requiring removal of the implants.

Out of this group of eight patients, 5 were follow-up for a mean period of 12 months. When last evaluated, their mean kyphos angle was 14 degrees and the mean difference in the pre- and post-operative kyphos angles was -8 degrees. Table 5 shows their pre- and post-operative neurological status.

It should be mentioned that follow-up assessments in both nonoperated and operated groups were hampered by the repatriation of foreign workers.

DISCUSSION

Holdsworth (7) described burst fractures, classifying them as "essentially stable". Other authors (2, 10, 15) have recognised the potential instability of this group of fractures which may give rise to immediate or late neurological damage and spinal deformity.

The radiographic appearance of a burst fracture has been described in detail (2, 11) and the features that have been used to identify burst fractures in this study are:

1. Increased in the interpediculate distance more than 3 mm when compared to either the level above or below,
2. Anterior wedge deformity,
3. Retropulsion of the posterior aspect of the vertebral canal.

Computerised Axial Tomograms were invaluable in assessing the size and position of retropulsed fragments and the reduction in the size of the neural canal caused by these fragments. It also showed the site of posterior column failure e.g. fractures of the laminae which were not recognised on the plain radiographs. It has been noted to be most sensitive, compared to other imaging modalities, in this last respect (10).

The present series is small and the patients have been followed up for a short period. As yet, no change in the neurological status or spinal deformity of the patients who have been conservatively treated has been noticed.

However, operative treatment of patients with an incomplete deficit serves to decompress the conus medullaris or cauda equina, stabilise the spine and correct the traumatic kyphosis (15). This has resulted in an improvement in the neurological status of two patients. In patients with a complete neurological deficit, surgical stabilisation of the fracture allows early mobilisation of the patient.

Frankel Grade		Last Follow-up	
On Admission	Postoperative	Return to Work	Backache
D	D	No	Yes
C	D	Yes	Yes
B	C	No	No
E	E	No	Yes
D	D	Yes	Yes

Table 5: **Progress of (5) Patients Operated upon**

Two case histories are presented to illustrate our operative management of burst fractures.

Case No. 1

P.P., a 23-year old Indian male was involved in a motorcycle accident and was subsequently paraparetic and unable to pass urine. He also sustained rib fractures.

Clinically, he was graded Frankel D. Radiographs of the thoracolumbar spine (Fig. 1a) showed a burst fracture of L1 vertebra with kyphos of 14 degrees. The CAT scan (Fig. 1b) showed fragmentation of the body of L1 vertebra with a break in the neural arch on the right.

Postural reduction of the fracture was carried out and the patient was catheterised. Ten days after the accident, anterior decompression and spinal fusion were performed and 3 weeks later posterior stabilisation with Luque sublaminar wiring was carried out (Fig. 1c).

The postoperative period was uneventful and he subsequently regained bladder control and was able to walk with a frame while wearing a corset. When last seen, 27 months after his injury, he was walking with a cane, and still had backache. His kyphos angle was 16 degrees (Fig. 1d) and he had not resumed work.

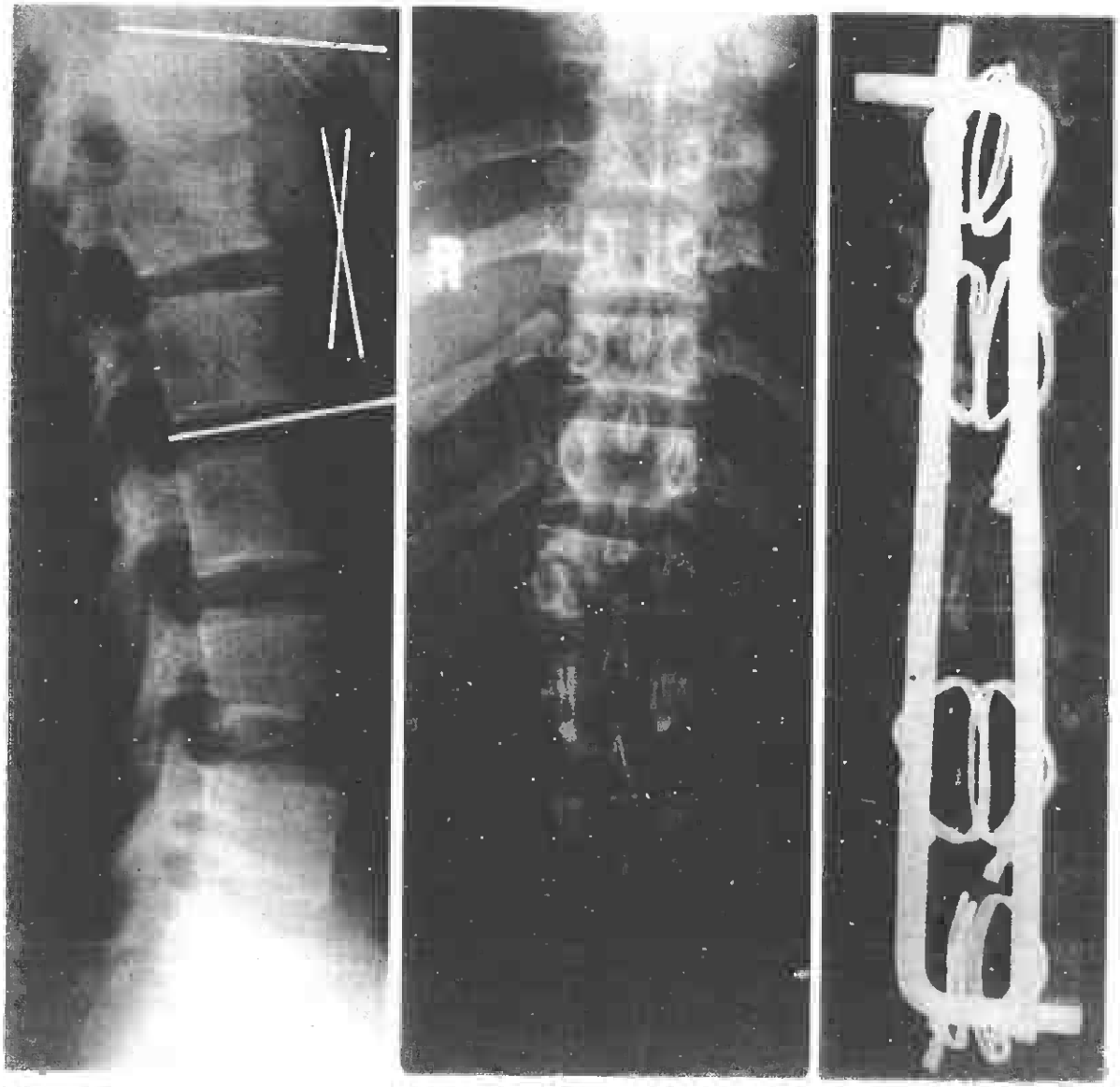


Fig 1(a) Anterioposterior and lateral Radiographs of P.P.

Fig 1(c) Post-operative Radiograph of P.P.

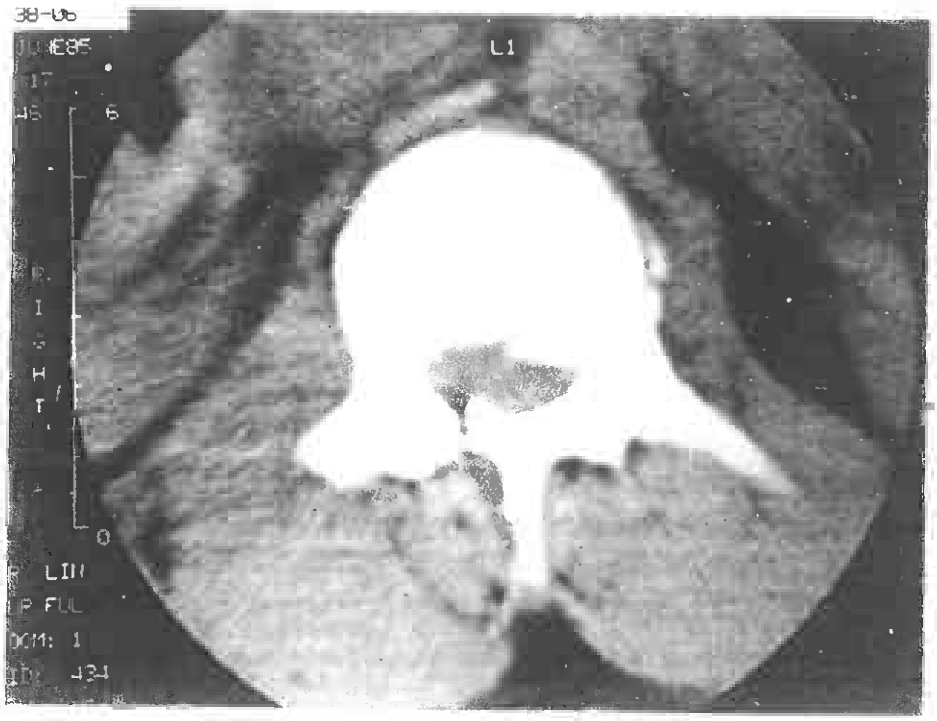


Fig 1(b) CAT of P.P.

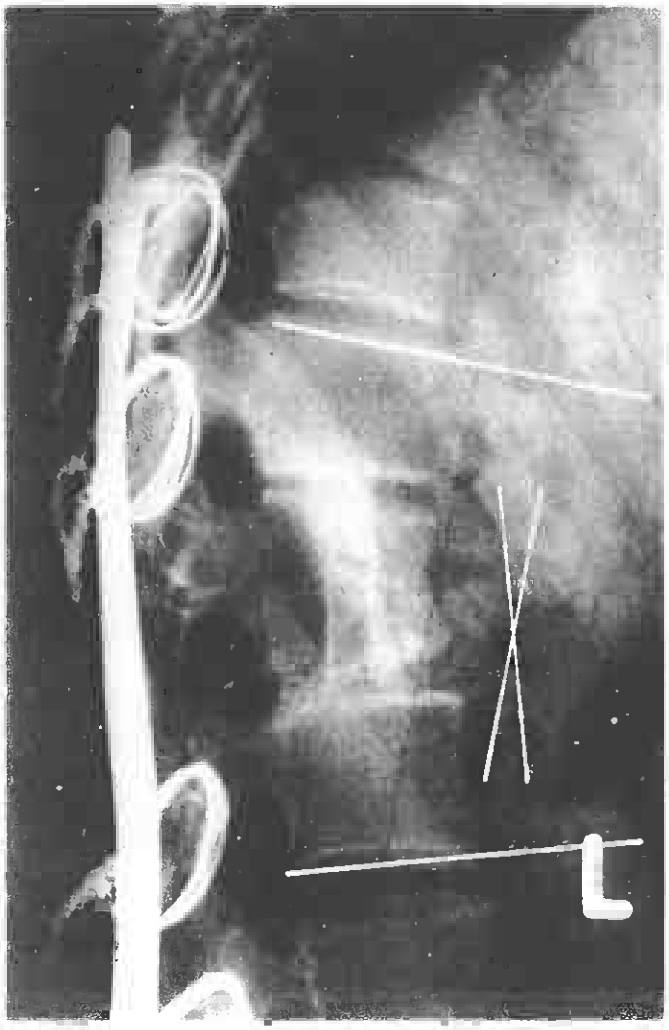


Fig 1(d) 27-month follow-up radiograph of P.P.

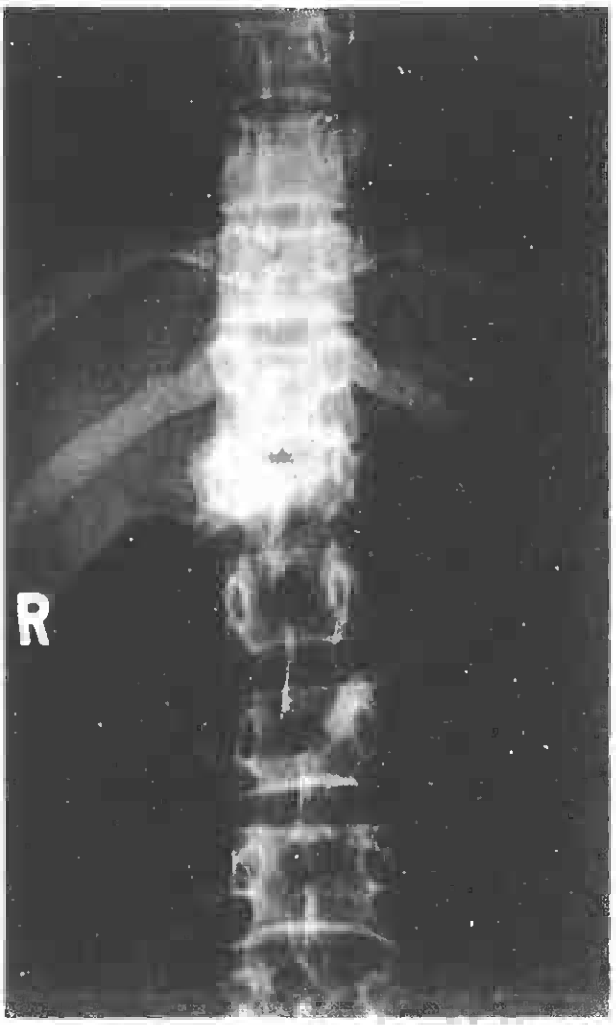


Fig 2(a) Anteroposterior Radiographs of L.K.K.

Case No. 2

L.K.K., a 23-year old air-stewardess, tripped and fell into a drain while jogging and was subsequently paraparetic and unable to pass urine.

Clinically, she was graded Frankel D. Radiographs of the thoracolumbar spine (Figs. 2a & 2b) showed a burst fracture of L1 vertebra with a kyphos angle of 28 degrees. The CAT scan (Fig. 2c) showed comminution of L1 vertebra with anterior-posterior narrowing of the neural canal caused by retropulsed fragments of the vertebral body.

After similar initial conservative treatment, posterolateral decompression and fusion together with posterior stabilisation using Harrington rods with sublaminar wiring were performed (Figs. 2d, 2e & 2f).

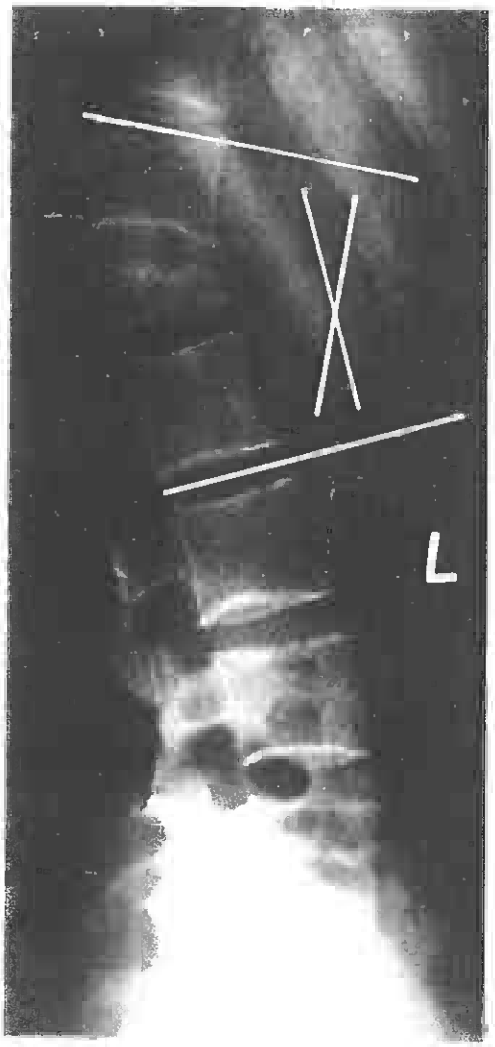
Post-operatively she was able to walk wearing a corset but had difficulty in micturition requiring intermittent catheterisation. An electromyogram showed a cauda lesion affecting mainly the dorsal (sensory) nerve roots. The thoracic part of one of the Harrington rods subsequently began to protrude through the skin and required cutting.

When last seen, 16 months after her injury, she had gone back to her previous job and had some backache. Her kyphos angle was 29 degrees (Fig. 2g) and there was no change in the Frankel grade.

CONCLUSION

The characteristics of 30 patients with 31 burst fractures of the throacolumbar junction have been described. A typical patient is a young, male, construction worker who sustains an Denis Type B burst fracture of the L1 vertebra after a fall. He is likely to escape neural damage and may expect to return to work.

While the burst fracture is a relatively uncommon spinal injury (13), Whitesides (15) has noted that unstable burst fractures are "the most common cause of neural injury in the thoracolumbar region". The CAT scan is invaluable in detecting posterior column failure and in assessing the degree of spinal canal compromise caused by retropulsed fragments of the vertebral body.



2(b) Lateral Radiographs of L.K.K.

Fig 2(d) post-operative Radiographs of L.K.K.

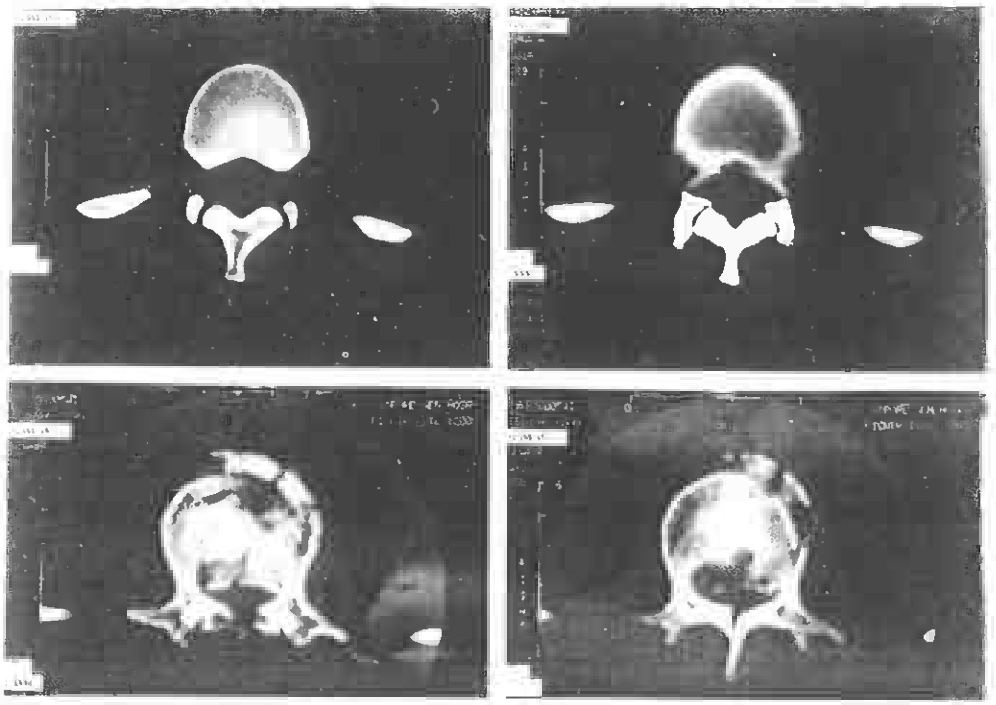
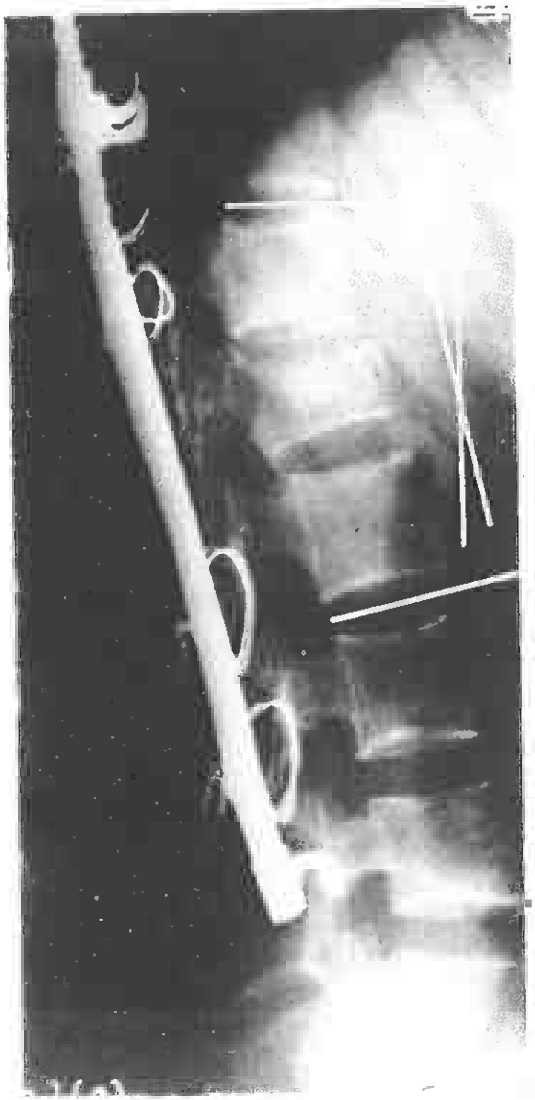


Fig 2(c) CAT sum of L.K.K.



2(e) post-operative Radiographs of L.K.K.

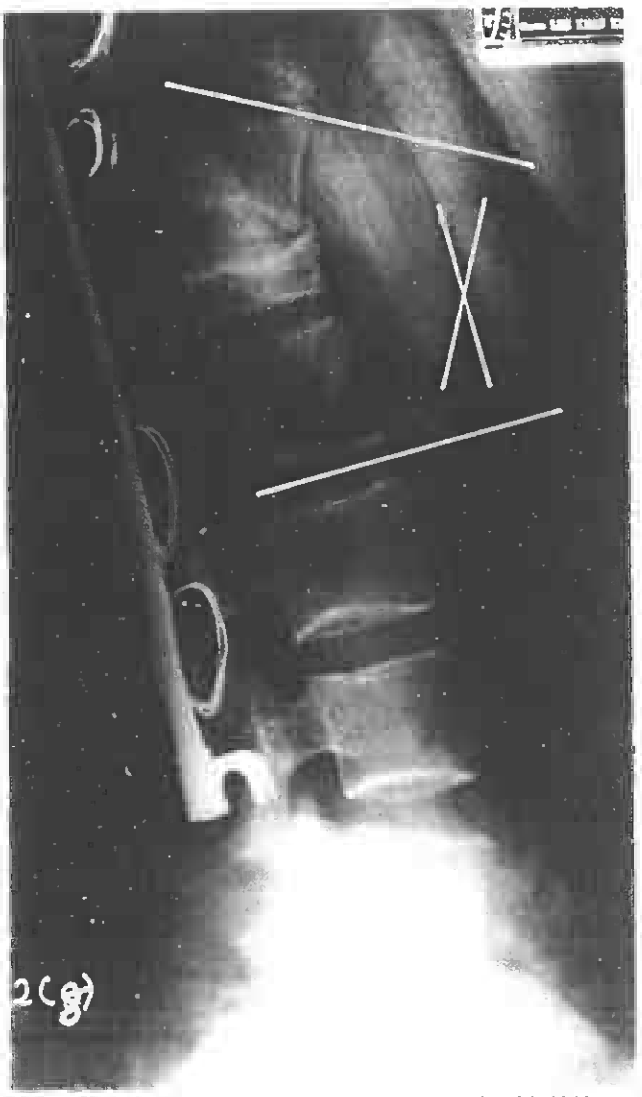
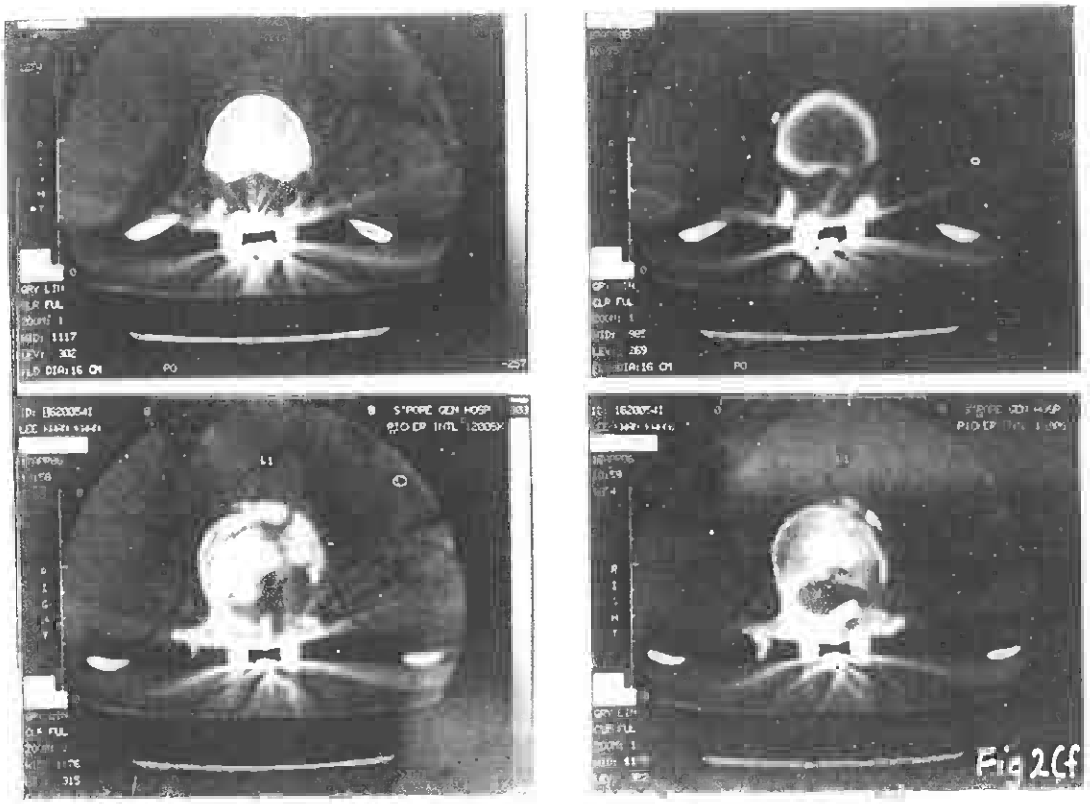


Fig 2g — 16-month follow-up radiograph of L.K.K.



2(f) post-operative Radiographs of L.K.K.

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