

Surgical treatment of tuberculous spondylitis

50 patients followed for 2–8 years

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We treated 50 adult patients with tuberculous spondylitis surgically and followed them for a mean of 5 (2–8) years. All had persistent back pain, 32 had neurologic deficit, and 13 had gibbus deformity. Anterior debridement and fusion were the main operative procedures. Additional posterior stabilization was performed in 14 patients who had loss of a vertebral body or for correction of severe

kyphosis. 30 of the 32 patients with neurological impairment had an improvement of 1–3 Frankel's grades after operation. All patients had some relief of pain. Solid bony union of the fusion was found in 46 patients and 4 had nonunion after anterior operation only. The average correction of the kyphotic angle was 10 degrees.

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Tuberculosis of the spine is still common in much of the world, including Taiwan. Gross kyphosis and neurologic deficits are frequent sequelae in patients treated by chemotherapy only. Radical debridement and anterior fusion have been advocated by Hodgson and Stock (1960), while others have claimed excellent results with additional posterior fusion and instrumentation in selected severe cases (Bailey et al. 1972, Kemp et al. 1973). In this report, we analyze the outcome in 50 patients with spinal tuberculosis treated by anterior decompression and fusion with or without adjuvant stabilization using posterior fusion and instrumentation.

Patients and methods

From 1984 to 1989, we treated 60 cases of tuberculous spondylitis surgically. This study is based on 50 patients with complete follow-up data. There were 17 women and 33 men with a mean age of 48 (20–73) years. The mean follow-up period was 5 (2–8) years. Diagnosis was confirmed by histopathologic examination.

Our treatment protocol was as follows: When spinal tuberculosis was clinically and radiographically diagnosed, 3 anti-tuberculous agents (isoniazid, ethambutol, rifampin) were given immediately. If a profound neurologic deficit was evident on diagnosis, or if progressive neurologic deterioration occurred, or intractable back pain continued during

adequate drug therapy, or substantial spinal instability and gibbus deformity developed, anterior surgical decompression with fusion was performed.

Spinal destruction, kyphotic deformity, instability and cord compression were assessed on preoperative radiographs. Supplementary CT was performed in 30 patients. The total loss of vertebral body height was evaluated by the index of Konstam and Blesovsky (1962) (Figure 1). The kyphotic angle was calculated according to Rajasekaran and Shanmugasundaram (1987).

All patients had back pain, 13 had gibbus deformity, and 2 had a sinus at the back of the thoracic region. 32 patients had various levels of neurologic deficits. The spinal segments involved ranged from C4 to S2 (Table 1). The thoracolumbar spine was the commonest site of the tuberculous lesion (Table 2).

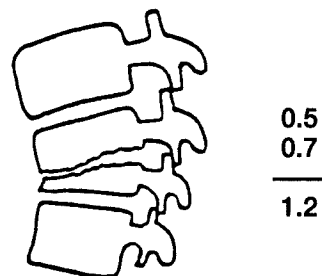


Figure 1. The index of vertebral body loss is the sum of the proportion of height loss for each of the vertebra that the lesion involves.

Table 1. Observations in 50 patients operated on for spinal tuberculosis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	31	2	1,3	E/E	25	1	1	3	2.3	27	10	15	2,3	L2/L4	L1/L5	1,3	74	2
2	29	2	1,2	E/E	54	2	2	4	4.8	57	43	60	1,4	T9/L1	T7/L2	1,3	78	1
3	73	1	1	C/D	48	1	2	2	1.5	10	9	10	1	T11/L1	-	1	30	2
4	28	2	1,2	D/E	70	2	2	4	2.3	34	20	24	1,4	T9/T12	T9/T12	1,3	80	1
5	41	1	1,2	D/E	30	1	1	2	2	16	6	12	2	L2/L3	-	1	58	1
6	56	1	1	D/E	81	1	1	2	2	22	3	17	2,4	L4/L5	L3/S1	1,3	93	1
7	35	1	1,2	E/E	43	1	1	2	1.8	24	29	5	2	L2/L5	-	1	62	1
8	29	1	1	E/E	39	1	1	2	0.8	2	2	2	2	L4/L5	-	1	81	1
9	36	2	1	E/E	17	1	1	2	1.2	8	5	0	2	L3/L4	-	2	81	2
10	26	2	1,2	C/E	49	1	1	4	3.7	77	52	55	1,3	T12/L3	T10/L4	1,3	29	1
11	26	2	1	E/E	91	1	2	2	1.8	19	17	16	1	T9/T10	-	1	24	1
12	58	1	1	C/E	10	1	1	2	0.3	7	5	6	1	T9/T10	-	1	98	1
13	33	1	1,2	E/E	58	1	1	2	1.3	70	70	58	1	L5/S1	-	1	68	1
14	57	1	1	B/D	65	1	1	2	1.5	22	2	4	1	T8/T9	-	1	86	3
15	70	2	1,2	B/E	96	1	2	2	1.5	20	15	19	1	T10/T12	-	1	76	1
16	50	1	1	E/E	69	1	1	2	2	41	31	31	1	T8/T9	-	1	68	1
17	42	1	1	C/E	72	1	1	3	2.5	24	16	20	1,3	T2/T4	T1/T4	1,3	70	1
18	39	2	1,3	D/E	106	1	2	2	0.5	19	19	19	1	S1/S2	-	1	77	1
19	49	1	1	D/E	4	1	1	2	0.4	5	-3	-5	1	L3/L4	-	1	76	2
20	72	1	1	D/E	44	1	1	3	1.2	28	18	23	2	T6/T9	-	1	49	1
21	44	2	1	B/E	47	1	2	2	1.3	5	4	4	2,5	C4/C6	C4/C6	1,3	68	1
22	38	1	1	D/E	12	1	1	2	1	12	8	10	2,5	C6/C7	C6/C7	1,3	47	1
23	26	2	1,2	D/E	16	1	1	2	2	26	0	2	2,3	L4/L5	L3/S1	1,3	56	1
24	49	1	1,2	C/D	10	1	2	5	4.5	68	45	63	1,4	T10/L3	T8/L4	1,3	68	2
25	20	1	1,2	E(S)/E	132	1	2	2	1.5	10	7	5	2	L4/S1	-	1	73	1
26	59	2	1,2	D/E	5	1	1	2	1.8	40	28	36	1	T9/T12	-	1	40	1
27	56	1	1	C/E	7	1	1	2	2	6	4	4	2,3	L2/L4	L1/L5	1,3	44	1
28	69	1	1	B/D	55	1	2	2	1.3	20	17	27	1	T9/T10	-	2	56	2
29	63	1	1	E/E	123	1	2	2	2	7	4	9	1	T9/T10	-	1	38	1
30	49	1	1,2	E/E	75	1	1	5	4.2	77	55	52	1,3	T9/L1	T8/L2	1,3	67	1
31	60	1	1	D/E	34	1	1	2	1.8	15	18	15	1	T7/T8	-	1	48	1
32	45	1	1	D/E	19	2	1	1	1	6	3	6	2	T9/T10	-	1	62	2
33	52	1	1	C/E	35	1	1	3	1.8	12	13	15	1	T8/T10	-	1	55	1
34	53	1	1	C/E	44	1	2	2	1.2	13	5	9	1	T8/T9	-	1	53	1
35	57	2	1	E/E	29	1	1	2	0.7	4	2	10	2	L1/L2	-	1	34	1
36	33	2	1	E(S)/E	38	1	1	2	0.8	16	10	1	2	L4/L5	-	1	50	1
37	34	1	1	C/E	59	1	1	4	4	31	25	25	1,3	T5/T8	T5/T8	1,3	35	1
38	61	1	1	C/D	68	1	1	2	1.2	17	21	26	1	T10/T11	-	1	40	2
39	53	2	1	D/E	74	1	1	3	1.5	42	37	32	2	T12/L2	-	1	86	2
40	67	2	1	D/D	110	1	2	4	2.8	34	30	30	2,3	L4/S1	L4/S2	1,3	41	3
41	67	1	1	E/E	50	1	1	2	0.7	30	25	28	2	L1/L2	-	1	79	2
42	57	1	1	C/E	112	2	2	2	0.8	17	6	14	1	T10/T11	-	1	83	1
43	27	1	1,2	C/E	54	1	1	2	1.2	33	23	39	1	T6/T7	-	1	100	1
44	64	1	1	B/E	36	1	1	4	2.8	41	13	24	1	T8/T11	-	1	40	2
45	72	1	1	E/E	53	1	1	2	0.3	8	1	11	1	L1/L2	-	1	19	1
46	41	1	1	E/E	26	1	1	3	1.8	47	41	36	2	T6/T9	-	1	85	1
47	54	2	1	C/C	49	1	1	3	2.3	18	5	25	1	T11/L1	-	2	89	3
48	58	1	1	E/E	68	1	1	2	0.3	50	9	6	1	T9/T10	-	1	82	1
49	58	1	1	D/E	26	1	1	2	0.5	16	11	3	1	L4/L5	-	2	24	2
50	58	2	1	D/E	50	1	2	2	2	13	9	16	1	L1/L3	-	1	27	1

A Case

B Age at operation

C Sex

1 male

2 female

D Symptoms and signs

1 back pain

2 kyphotic deformity

3 sinus discharge

E Pre-/postoperative evaluation of

neurologic deficit according to

Frankel et al. 1969

A complete, no function below the

lesion of the cord

B sensory only, no motor function

C motor function useless

D motor function useful

E free of neurologic symptom

(S) sphincter function impairment

F ESR (mm/h)

G Acid-fast test

1 negative

2 positive

H TB culture

1 negative

2 positive

I Number of vertebrae affected

J Total loss of vertebral body (TL)

K Preoperative kyphotic angle

L Postoperative kyphotic angle

M Latest follow-up kyphotic angle

N Treatment options

1 Anterior decompression and

fusion with ribs

2 Anterior decompression and

fusion with iliac graft

3 Posterior fusion with iliac graft

and Luque SSI

4 Posterior fusion with iliac graft

and Harrington rod

5 Posterior Roger's fusion

O Anterior spinal segment fusion level

(upper / lower)

P Posterior spinal segment level stabi-

lized with instrument (upper / lower)

Q Fusion result

1 Anterior fusion, solid union

2 Anterior fusion, pseudarthrosis

3 Posterior fusion, complete

R Latest follow-up, months

S Back pain improvement

1 no back or leg pain

2 pain much improved with rare

medication

3 pain improved some with

frequent medication

Table 2. Distribution of total vertebral involvement in 50 patients with tuberculous spondylitis

Level	Number of vertebrae
C4	1
C5	1
C6	1
C7	1
T2	1
T3	1
T4	1
T5	1
T6	3
T8	10
T9	16
T10	15
T11	10
T12	9
L1	10
L2	9
L3	7
L4	11
L5	9
S1	5
S2	2

The average erythrocyte sedimentation rate was 51 (4-132) mm per hour. The acid-fast test of the specimen was positive in only 4 cases, while the culture was positive in 15 patients. The preoperative vertebral body index was smaller than 2 in 32 patients, between 2 and 3 in 13 patients, and greater than 3 in 5 patients. The average loss was 1.7 (0.3-4.8). The preoperative kyphotic angle averaged 25 (2-77) degrees.

For the 30 patients whose vertebral body index was smaller than 2, the routine procedure was anterior debridement and interbody fusion with rib strut or iliac tricortical bone grafts. Slight correction of the kyphosis occurred during insertion of the bone graft. After operation, a body cast or body jacket was applied for several months depending on the healing condition of the bone graft (Figure 2). Of the 13 patients with a vertebral body index between 2 and 3, 6 had an anterior operation and 7 others, who also had severe kyphosis and spinal instability, had an additional second-staged posterior fusion and instrumentation



Figure 2. Case 19. A 49-year-old man with spinal tuberculosis from L3-L4 with Frankel's grade D neurologic deficit.



Anterior decompression and fusion of L3-L4 were performed. After 2 years radiographs showed solid bony union and lumbar lordosis reappeared. The function was normal.

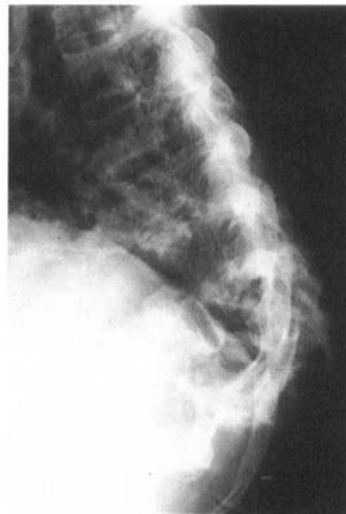


Figure 3. Case 10. A 26-year-old man had spinal tuberculosis from T12-L3 with Frankel's grade C neurologic deficit.



After anterior decompression and fusion of the 4 vertebrae, posterior spondylodesis was performed with Luque SSI. At 5 years' follow-up, he had a complete restoration of neurologic function and pain relief.

with Harrington rod or Luque SSI. In all 5 cases, where the vertebral body index was greater than 3, two-staged anterior and posterior procedures were performed (Figure 3). A body jacket was used for 3 months after the operation. 2 cases of cervical tuberculous spondylitis had a combined anterior operation and posterior Roger's fusion (Figure 4). Neck braces were used postoperatively. The anti-tuberculous drugs were given for at least 1 year postoperatively.

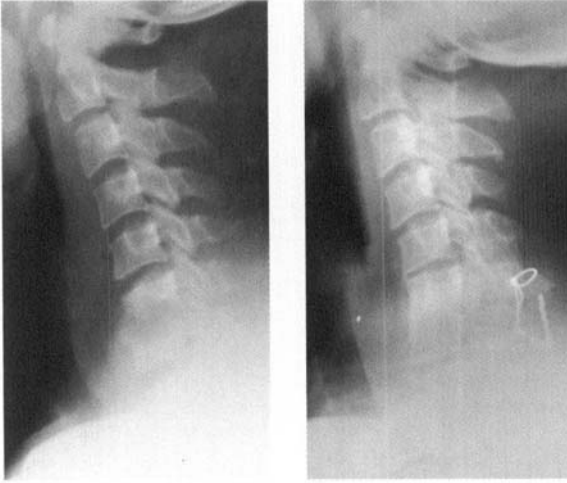


Figure 4. Case 22. A 29-year-old man had spinal tuberculosis at C6-C7 with Frankel's D neurologic deficit.

He was treated with anterior decompression and fusion with autogenous iliac bone graft and posterior Roger's fusion. Solid bony union with complete pain relief and neurologic recovery was reached after 4 years.

At the follow-up, plain radiographs including anteroposterior and lateral projections were obtained at 3, 6, and 12 months and then yearly. Neurologic recovery, back pain improvement, and ambulation were clinically evaluated.

Results

Neurologic recovery

30 of 32 patients with a neurologic deficit improved and ambulation was regained in 25 patients (Table 3). The best results were obtained among the 12 patients with Frankel's grade C neurologic deficits, 11 of whom were able to walk postoperatively. No improvement in neurologic function was observed in 1 of the 12 grade C and 1 of the 15 grade D patients. In none of the patients did the neurological condition deteriorate. 2 cases of cauda equina syndrome had complete recovery. Neurologic recovery from admission to the latest follow-up averaged 1.4 (1-3) grades.

Back pain improvement

All the patients had some relief of pain and 35 patients had no back or leg pain. 12 patients were considerably improved and needed only occasional analgetic medication whereas 3 patients needed frequent analgesics.

Table 3. Pre- and postoperative neurologic grade according to Frankel et al. (1969) in 50 patients treated for spinal tuberculosis

Preoperative	Postoperative					Total
	A	B	C	D	E	
A	-	-	-	-	-	0
B	-	-	-	2	3	5
C	-	-	1	3	8	12
D	-	-	-	1	14	15
E	-	-	-	-	18	18
Total	0	0	1	6	43	50

Table 4. Pre- and postoperative change in kyphotic deformity (degrees)

Levels	Total	Preop	Postop	Latest follow-up
C	2	9	6	7
T	22	25	16	19
T-L	7	15	8	9
L	15	50	35	42
L-S	3	38	36	31
S	1	19	19	19

Fusion rate

All 14 patients who had combined anterior and posterior operations had radiographically solid bony union after 1 year. 32 of the 36 patients who only had an anterior operation developed a solid bony union. The remaining 4 patients had pseudarthroses on the latest radiographs at 2, 5, 7, and 7 years of follow-up, respectively. None of them had symptoms and signs to warrant revision.

Correction of kyphotic deformity

42 patients had immediate postoperative correction of kyphosis. At the latest follow-up, there was usually an increase in kyphosis compared to the immediate postoperative status. The average final correction of the kyphotic angle was 10 (1-44) degrees in 35 patients. 10 patients had deterioration of the kyphotic angle, mean 4.8 (2-9) degrees, all of whom had undergone an anterior operation only. 5 patients had no change in the kyphosis after operation (Table 4).

Discussion

Spinal tuberculosis in Taiwan is primarily a disease of adults. Most lesions are found in the lower thoracic and thoracolumbar region (Dobson 1951, Hodgson and Stock 1960, Medical Research Council 1973, 1974, 1978, Riska 1976, Paus 1977, Chahal

and Jyoti 1980). The first symptoms are usually pain, low grade fever, chills, and weight loss. In more advanced disease, cold abscesses, neurological deficits, sinus tracts, and kyphotic deformities are found. In our patients, persistent back pain, progressive kyphosis, and neurologic deficit were the commonest symptoms. Kyphosis is an important cause of morbidity. In the Medical Research Council reports (1973a,b, 1974a,b, 1978a,b), the mean angle of kyphosis varied from 20 to 34 degrees. Tuli and Kumar (1971) reported that the lumbar vertebral bodies were more apt to telescope than to angulate, while the cervical spine was prevented from telescoping by the interposition of the lateral masses. In our series, kyphotic deformity occurred mostly in the thoracolumbar junction (average 36 degrees), and the thoracic spine (average 28 degrees).

Neurologic deficits are common. Seddon (1935) reported that the degree of neurologic involvement observed in patients with spinal cord or root compression relates to the outcome. Those with complete loss of motor function have a poor prognosis, while those with preservation of some voluntary muscle control, as well as sphincter control and sensory function, have a much better prognosis, particularly if surgical decompression is carried out expeditiously. In our series, there was no case with complete paralysis. 32 patients had neurologic deficits of Frankel's grades B-D. Of these patients, 30 patients had improved by 1-3 Frankel's grades after operation.

Konstam and Blesovsky (1962) advocated closed treatment of spinal tuberculosis, using chemotherapy alone. In patients treated ambulatory with isoniazid and aminosalicyclic acid for 1 year, 86 percent healed after 2 years and bony fusion occurred in 74 percent. Hodgson and Stock (1960) combined chemotherapy with a radical surgical approach, including abscess drainage and anterior spinal fusion: 94 percent had a good functional result, and in 74 percent the preoperative paraparesis improved. These 2 studies showed similar results with different treatments. To solve this controversy, the Medical Research Council of England has carried out prospective multicenter studies of spinal tuberculosis in Africa and Asia since 1973. These studies reveal that 82-88 percent of all patients receiving chemotherapy alone will achieve a favorable result over a 3-year period (Medical Research Council 1973a,b, 1974a,b, 1976, 1978a,b, 1982). However, gross kyphosis, neurologic deficit and delayed bony union are frequent results.

Our mainstay in the surgical treatment of the tuberculous spine is radical debridement and anterior fusion. Posterior fusion and instrumentation are addi-

tionally performed in patients with severe vertebral loss or kyphosis. Anterior debridement and fusion allow direct access to the focus of the disease, decompression of the cord and rapid healing by bony union and a decreased tendency for progressive kyphosis. We did not use anterior stabilizing instrumentation. For posterior fusion, Harrington or Luque instrumentation seems sufficient.

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