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Operative treatment of progressive deformity in spinal tuberculosis

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Abstract We report on 14 patients with tuberculosis of the spine treated by operation. All had disease of three or more vertebrae with involvement of both the anterior and posterior columns and a progressive kyphotic deformity in spite of conservative treatment. We consider such spines to be ‘unstable’ and have found that anterior as well as posterior fusion with instrumentation is necessary.

Résumé Nous rapportons 14 cas de patients atteints de tuberculose rachidienne traitée chirurgicalement. Tous avaient une affection de trois vertèbres ou plus, avec une atteinte de la colonne antérieure et de la colonne postérieure et une cyphose progressive malgré le traitement conservateur. Nous avons considéré de telles colonnes vertébrales ‘instables’ et avons trouvé qu’une double instrumentation, antérieure et postérieure était nécessaire.

Introduction

With the discovery of chemotherapeutic drugs in the late 1940s and early 1950s tuberculosis became curable in virtually all patients [12]. Eradication of infection is the primary aim of treatment in spinal tuberculosis. In addition, correction or prevention of an increase in angular deformity together with recovery from any neurological deficits are further aims.

Kyphotic deformity cannot be arrested by conservative treatment [7], and with non-surgical treatment neurological recovery is slower and occurs in a smaller percentage of cases [5]. Fusion of the diseased area of the spine can be produced by non-operative treatment, but the kyphosis persists [9, 10, 11].

While surgical treatment using the radical operation described by Hodgson improves the outcome especially in relation to angular deformity and the time needed for fusion [5, 8], this may not be true when there is instability of the spine secondary to severe spinal tuberculosis. White and Panjabi [13] defined clinical instability as the inability of the spine under physiological loads to maintain the relationship between vertebrae in such a way that the spinal cord or nerve roots are not damaged or irritated, and that neither deformity nor pain develops. Clinical instability of the spine may be caused by trauma, neoplastic disease or infections, which may be acute or chronic. Chronic instability is associated with progressive deformity and may cause neurological deterioration, increasing pain or decreasing function [13].

Weaver and Lifeso [12] showed that the most common site of initial infection in spinal tuberculosis is in the vertebral end plate; narrowing of the disc space and anterior wedging follows this. In our 14 patients we noted that involvement of more than two vertebrae increased the kyphotic deformity by more than 20° [11].

A further radiological observation is the progression of the deformity in spite of conservative treatment. This shows that progressive deformity may occur in spite of healing and this also indicates instability [13].

Another observation is that involvement of anterior and posterior columns of the spine also results in instability. Therefore we believe that these three radiological criteria indicate instability in tuberculosis of the spine. In our opinion spinal tuberculosis with instability calls for fusion and fixation using combined anterior and posterior surgery. Fourteen such patients are presented together with the results of treatment and the advantages of this method of treatment.

Materials and methods

Fourteen patients with spinal instability due to tuberculosis were admitted to the Spinal Unit of the Riyadh Medical Complex. They all showed progressive deformity, involvement of three or more vertebrae or combined anterior and posterior disease of the relevant verte-

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Fig. 1 A Pre-operative X-ray of disease of four vertebrae (D11, D12 and L1, L2). B X-ray after anterior decompression and bone grafting. C X-ray after posterior stabilisation

Table 1 Degree of corrections after two-stage or one-stage anterior and posterior surgery (AS anterior surgery, PS posterior surgery)

Age	Sex	Site of infection	Kyphosis in degrees			Neurological status (Frankel)	
			Pre-op.	Two-stage		Pre-op.	Latest
				Post AS	Post PS		
4	F	D11-L2	86	55	26	D	E
25	M	L1-L5	18	12	4	D	E
26	N	C7-D3	26	11	6	B	D
15	F	C3-C5	50	25	8	D	E
27	F	D11-L2	72	56	18	D	E
25	M	D11-L1	38	25	10	E	E
18	F	D12-L2	40	30	13	E	E
30	F	D8-D11	58	48	38	C	D
One-stage							
4	F	D7-D10	85	50		E	E
13	F	D7-D12	108	78		E	E
13	F	C4-C6	28	2		C	E
60	M	D9-D12	38	20		C	D
40	F	C2-C4	26	-4		D	E
32	M	D12-L2	22	-2		D	E

brae. Their age ranged from 4 to 60 years (average 23.7 years) and only two were children. There were nine females and five males. All the patients presented with back pain during a period ranging from 3 weeks to 6 years and they all had a kyphotic deformity. On admission seven patients had a cold abscess and three had other tuberculous lesions (one had pulmonary tuberculosis, one had intra-orbital tuberculosis and the third had cervical lymphadenopathy). Frankel's method [3] was used for pre-operative neurological assessment. No neurological deficit was found in four patients either pre-operatively or after surgery. The other ten patients had various neurological lesions but all these improved postoperatively (Table 1).

Diagnosis was based on clinical and haematological criteria. All the patients had a positive Mantoux test and typical radiological features except for one individual who presented with an atypical bi-facet dislocation in the cervical spine as a result of tubercu-

lous bone disease. Histopathological examination in all patients revealed typical tuberculous granuloma.

Deformity was measured from the superior end plate of the proximal healthy vertebra to the inferior end plate of the distal healthy vertebra, and we found an average kyphosis deformity of 50° on admission.

The vertebrae affected in each patient are shown in Table 1. All except one patient had three or more vertebrae affected (average 3.7 vertebrae; Fig. 1). Involvement of both anterior and posterior arches was found in seven (Figs. 1A, 2A, B) including one case of atypical bi-facet cervical spine dislocation [1]. One patient had undergone previous multiple laminectomies with resulting posterior instability similar to that seen with posterior arch disease. Two patients had progressive deformity in spite of medical treatment and external immobilisation.

Fig. 2 A CT scan showing disease of anterior and posterior column. B MRI showing disease of anterior and posterior column

As soon as the diagnosis was established, anti-tuberculous treatment with rifampicin, I.N.H., ethambutol and pyrazinamide was started. Ethambutol and pyrazinamide were stopped after 2 months but rifampicin and I.N.H. were continued for another 10 months. Operation was carried out in two stages in eight patients with debridement (with or without anterior decompression and grafting) done in the first stage, as described by Hodgson and Stock [4]. The second stage, consisting of posterior fusion and instrumentation, followed after an average time interval of 16 days. Six patients were operated on in one stage; this involved debridement and anterior surgery with grafting followed by turning the patient to a prone position in order to allow posterior fusion with fixation. The bone graft for the anterior fusion was taken from the iliac crest in all patients but one (case 5) where a fibular graft measuring 3 inches was used. Different methods of fixation were employed according to the age of the patient and the site of the disease. Posterior fusion was considered necessary to produce the required stability of the diseased segments.

All patients were allowed to walk in a plastic body jacket within 2 weeks of the operation. Those with cervical tuberculosis were allowed up after the same period of bed rest, using a cervical collar.

Follow-up examination was performed during the first year at 6 weeks, 3 months, 9 months and 1 year. Subsequent follow-ups were at six monthly intervals. Total follow-up ranged from 10 to 96 months (average: 40 months).

Results

The results were assessed in relation to the area of bone fusion, correction of deformity, neurological recovery

and postoperative complications. Bone fusion was assessed both clinically and radiologically during the regular follow-up visits. Satisfactory fusion had occurred in all patients within a period of 4 to 9 months. We found even earlier fusion in patients with cervical disease.

Kyphotic deformity and the extent of correction in each patient are shown in Table 1. The average deformity on admission was 45° and this was corrected to an average of 19° postoperatively (62% correction). The eight two-stage procedures produced correction after anterior decompression of the kyphotic deformity (first stage) from 49° to 33° (32% correction); after the second stage the deformity was corrected to an average of 15° (68% correction; Fig. 1B, C).

Neurological recovery was noted in all of the ten patients who presented with a neurological deficit (Table 1). The six with grade D recovered to normal. One patient with grade B improved to grade D, two with grade C improved to grade D and one with grade C recovered completely. No patients deteriorated and this includes those with no neurological deficit pre-operatively. General complications encountered after surgery included two chest infections of which one was followed by infection of the wound. The three specific complications were probably related to the surgical approach undertaking anterior surgery before posterior fixation and fusion. These included one patient with anterior graft displacement, and another with graft distraction. However, as the posterior fixation was secure no adverse effects developed. On one patient Harrington rods became dislodged 6 months after operation and although this had allowed partial loss of correction (from 20° to 30°) the spine had fused so only the rods required removal.

Discussion

Surgical treatment of tuberculosis of the spine remains controversial. Indications for surgery vary from one Centre to another. Surgical techniques also vary with anterior debridement and fusion as the most popular procedure. Some authors prefer posterior instrumentation before or after an anterior debridement.

Radical debridement and arthrodesis as described by Hodgson achieved a significantly higher percentage of bone fusion with less vertebral body loss [7]. Neurological improvement was more rapid in these cases when compared to patients treated conservatively [7]. In patients reviewed 20 years after infection [10] conservative treatment alone was followed by kyphosis and trunk shortening. Anterior fusion helped in the correction of deformity [8] but only to a limited extent. In our series correction of the kyphosis following anterior fusion in the two-stage operation was 32%. This improved to 68% when followed by a posterior fusion and stabilisation. We performed posterior fusion and fixation as a second stage after an average interval of 16 days concentrating on the radical local debridement in the first stage. In time we changed to performing both stages simultaneously, again starting anteriorly and then fixing posteriorly. However, recently we have changed our

technique and now first perform a posterior fixation in order to reduce deformity, which is followed by anterior debridement and fusion. Posterior fusion with instrumentation should also help to encourage neurological recovery as rigid stabilisation of the spine has been shown experimentally to increase the likelihood of neurological recovery [2]. This occurred in the ten patients with a neurological deficit in our series. The inherent threat of infection or its exacerbation in the presence of metal instrumentation has not occurred with this method of treatment. Only one patient developed a wound infection; this followed a chest infection and settled with conservative treatment. Rigid stabilisation of the spine allows early mobilisation of these patients when compared to the prolonged periods of immobilisation which were originally recommended [6].

In conclusion, we believe that progressive deformity, disease of three or more vertebrae, or the destruction of the anterior and posterior columns indicate a degree of instability of the spine demanding anterior and posterior debridement with fusion and instrumentation. In our 14 patients this has resulted in an improvement in the correction of the deformity as well as encouraging neurological recovery and allowing early mobilisation.

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