

The Outcomes of Combined Posterior Instrumentation and Anterior Radical Debridement with Fusion for Multilevel Spinal Tuberculosis

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Background: Aside from antituberculous drugs, anterior radical debridement with fusion has been recommended to eradicate the infectious foci and promote early bone healing in spinal tubercular patients. The addition of spinal instrumentation to stabilize the spine and restore physiologic alignment has also been proposed.

Objective: This study was undertaken to evaluate the effectiveness of the combined posterior instrumentation and anterior spinal fusion procedure.

Material and Method: Eleven consecutive patients who were diagnosed with tubercular spondylitis involving more than one vertebral level and who received combined posterior instrumentation and anterior spinal fusion were reviewed. The number of vertebrae involved was three levels in four patients and two levels in seven patients. There were 8 one-stage and 3 two-stage procedures. The mean follow-up time was 16 months (range 7-33). Patients were evaluated before and after surgery for kyphotic correction, fusion formation, and neurological status.

Results: The average pre-operative, immediate postoperative, and last follow-up kyphotic angles were 40, 19, and 23 degrees, respectively. All patients obtained solid bony fusion, except for one who had partial graft dislodgment. There was no serious complication, such as neurological injury or deep wound infection.

Conclusion: Posterior instrumentation and anterior interbody fusion was effective in the management of multilevel spinal tuberculosis, as this procedure can effectively eradicate disease, provide bony fusion, correct deformity, and prevent the progression of kyphosis.

Keywords: Tubercular spondylitis, Spinal fusion, Instrumentation, Multi level

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Although antituberculous chemotherapy is essential in the management of spinal tuberculosis, surgical interventions are still indicated in certain conditions. Since the disease primarily involves the anterior vertebral structures, anterior radical debridement with arthrodesis is recommended^(1,2). This procedure allows the abscess to be evacuated, all avascular material to be excised, and the spinal cord to be adequately decompressed. Kyphosis can also be corrected or at least stabilized with the use of bone graft. Satisfactory results of radical surgery in terms of resolution, recurrence, deformity, and neurological recovery have been reported^(3,4). However, the procedure is not always successful in correcting the

pre-existing kyphosis and preventing the progression of kyphosis⁽⁵⁻⁷⁾. The recurrence of deformity is still common in extensive disease cases with multilevel involvement.

Spinal instrumentation has been advocated as a supplement to radical debridement and fusion. Posterior stabilization of the spine provides segmental stability, prevents bone graft failure, and diminishes deformity progression^(8,9). This procedure, however, increases the operating time, causes more blood loss, and may be associated with higher postoperative morbidity.

The present study evaluates the effectiveness of combined posterior spinal instrumentation and anterior radical debridement with fusion in the patients diagnosed with multilevel spinal tuberculosis.

Material and Method

The present study was conducted on patients who had active spinal tuberculosis involving more than

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one spinal segment and who underwent anterior fusion spanning more than one disc space. Eleven patients were included (Table 1). There were 5 males and 6 females. Nine patients were adults and the others were children. The age of the patients ranged from 7 to 72 years. Severe back pain presented in all patients and leg pain was found in three. Neurological deficits presented in three patients: conus medullaris syndrome in one patient and radiculopathy in two. Eight patients had previously received antituberculous medication and two of them had undergone previous surgical drainage. The number of affected spinal segments was three in 4 patients and two in 7 patients. The affected spinal segments were located mostly in the thoracolumbar region, except for two cases that had lower lumbar involvement.

All patients underwent anterior radical debridement with fusion combined with posterior spinal instrumentation. The anterior fusion spanned across two disc spaces in 7 patients and three disc spaces in 4 patients (Table 2). The bone grafts that were used for fusion were autologous iliac crest in adult patients and ribs in children. Posterior spinal instrumentation was applied spanning at least two levels above and below the anterior fusion. The operations were one-stage procedures in 8 patients and two-stage procedures in 3 patients. Posterior instrumentation was performed prior to anterior debridement and fusion in 7 patients, while the other patients underwent anterior debridement first. The tissues harvested from anterior radical debridement were collected for AFB stain and pathological examination. A positive AFB stain was found in 3 cases and pathological findings consistent with tuberculosis were presented in 9 patients.

The patients were immobilized with

thoracolumbar or lumbosacral orthoses for 2-3 months after surgery. A combination of antituberculous drugs, consisting of isoniazid (H), rifampicin (R), ethambutol (E), and pyrazinamide (Z), were administered for 12 months after surgery (2HREZ/10HRE). The patients were followed-up every month for the first 3 months and every 3-6 months thereafter.

The medical records of all patients were reviewed for operative time, blood loss, and complications. Postoperative and follow-up x-rays were compared with pre-operative films to determine bone fusion success and deformity correction. Pain, functional status, and relapse of the disease were also assessed.

Results

The average operative time was 359 minutes (range 260-480) (Table 2). There was no significant difference between the operative time in the one-stage procedure, which was 349.4 minutes, and the two-stage procedure, which was 338.5 minutes. The average blood loss was 1,359 mL (range 600-2,000). The average blood loss for the one-stage procedure, which was 1,243.7 mL (range 600-2,000), was less than the two-stage procedure, which was 1,666.7 mL (range 1,450-1,850). There was no serious immediate complication in any of the cases, such as neurological deficit or wound infection. Partial graft dislodgment occurred in one patient who had had the anterior surgery performed before the posterior procedure. However, the graft did not displace further, so solid bone fusion was eventually achieved. The patients who underwent pre-operative radiculopathy had complete neurological recovery immediately following surgery, except for one patient who had conus medullaris involvement and regained

Table 1. Summary of clinical data for the 11 patients with spinal tuberculosis

Patient No.	Sex	Age	Affected level	Neurological deficits	Previous Treatment
1	M	8	T11-L2	No	Anti-TB drug
2	F	18	T11-L2	No	No
3	M	69	L1-L3	Conus medullaris syndrome	Anti-TB drug
4	M	13	T11-L2	No	Anti-TB drug, debridement
5	F	30	T10-T12	No	Anti-TB drug
6	F	40	T12-L3	No	Anti-TB drug, debridement
7	F	22	T10-T12	No	Anti-TB drug
8	M	46	L2-4	Radiculopathy	Anti-TB drug
9	M	43	L3-5	Radiculopathy	Anti-TB drug
10	F	40	L1-L3	No	No
11	F	50	T11-L1	No	No

Table 2. Surgical results of spinal tuberculosis treated by posterior instrumentation and anterior radical debridement with fusion

Patient no.	Instrumented level	Graft type	No. of stages	1st stage approach	Oper. time (min.)	Blood loss (mL)	Pre-op. kyphosis (°)	Post-op. kyphosis (°)	Final kyphosis (°)	Follow-up period (months)	Complications
1	T9-L3	Ribs	One	Anterior	300	800	54	34	40	18	No
2	T9-L3	Iliac crest	One	Anterior	360	1,500	50	15	16	12	Graft dislodge
3	T10-L4	Iliac crest	One	Posterior	480	1,400	15	5	7	12	No
4	T9-L3	Ribs	One	Posterior	260	1,300	46	38	40	8	Sinus tract
5	T7-L3	Iliac crest	One	Posterior	360	1,000	64	36	40	18	No
6	T9-L4	Iliac crest	One	Posterior	430	2,000	72	22	30	14	No
7	T8-L2	Iliac crest	One	Posterior	315	600	51	26	26	6	No
8	T11-L5	Iliac crest	One	Posterior	290	1,350	20	4	10	21	No
9	L3-L5	Iliac crest	Two	Anterior	330	1,850	10	-2	6	33	No
10	T11-L5	Iliac crest	Two	Anterior	405	1,700	32	5	16	17	No
11	T10-L3	Iliac crest	Two	Posterior	420	1,450	24	24	24	17	No

neurological function only gradually as a result.

The average pre-operative, immediate postoperative, and last follow-up kyphotic angles were 40, 19, and 23 degrees respectively. Ten patients were pain-free, had no relapse of the disease, and had resumed their previous activity level at the final follow-up. The eleventh patient, who was lost to follow-up and had discontinued antituberculous drugs after three months, experienced moderate pain and persistent sinus drainage at 8 months, postoperatively. The fusions were solid in all patients, except the one who was lost follow-up.

Discussion

Spinal tuberculosis is the most common site (more than 50%) for musculoskeletal tuberculosis. The anterior column of vertebrae is most affected in spinal tuberculosis patients. Extensive disease was characterized by cases that involved more than one vertebra. Multilevel spinal tuberculosis has been previously reported with high prevalence (76.5-99%)⁽³⁻⁵⁾.

Multilevel spinal tuberculosis patients should be carefully evaluated for treatment. The number of involved vertebral bodies in spinal tuberculosis correlates with the severity of the disease, which may include severe kyphotic deformity and large abscess size. However, the number of level involvement is not a risk factor for neurological deficit in spinal tuberculosis^(4,10).

Surgery for spinal tuberculosis treatment has consistently developed with improved clinical outcomes. Hodgson et al first proposed that anterior debridement and anterior fusion in the spinal tuberculosis patient provided more benefit than chemotherapy alone⁽²⁾. From an important clinical trial undertaken by the Medical Research Council Working Party on Tuberculosis of the Spine, the results of conservative treatment were compared with surgical treatment. Patients were randomly assigned to three groups: chemotherapy alone, anterior radical debridement, and anterior radical debridement plus anterior fusion. Although a favorable outcome of 87% was reported, the resulting data supported a distinct advantage in treatment with anterior radical debridement followed by anterior fusion; specifically in terms of earlier complete bony fusion and less progressive kyphotic deformity, as compared to the other two groups⁽³⁾. Many research authors have advocated reconstructing the anterior column after complete radical debridement and have reported favorable clinical

outcomes with this technique^(3,6,11-13).

Although anterior radical debridement and anterior fusion is a popular procedure for treating anterior column involvement in spinal tuberculosis patients, progressive kyphotic deformity has been reported by some authors^(5,10,14). Progressive kyphotic deformity after anterior fusion is primarily the result of graft failure, such as graft fracture, graft dislodgment, and graft subsidence^(5,9,12). Rajasekaran and Soundarapandian reported that progressive kyphotic deformity was found in 41% of spinal tuberculosis patients who were treated with debridement and anterior fusion. Multilevel involvement is the dominant factor relating to the progression of kyphosis in his series, given that the longer length of bone graft increases the incidence of graft failure⁽⁵⁾.

Stabilization with implant after anterior debridement and fusion has been advocated to prevent the progression of kyphosis. Anterior instrumentation has the benefit of stabilizing vertebrae in the same approach and in a limited number of fusion levels⁽¹⁵⁻¹⁷⁾. However, in the anterior approach, multilevel spinal tuberculosis may require extensive approaches to reach good bone quality for fixation. This may be somewhat technically complicated, especially at the thoracolumbar junction. Moreover, reoperation to remove an anterior implant is a complex operation⁽¹⁷⁾. Conversely, posterior instrumentation is a more simple technique that allows for easier fixation to spinal bone of good quality and results in improved kyphotic correction^(9,18-20).

In the present study, we used combined approaches: the anterior approach for radical debridement and bone grafting and the posterior approach for instrumentation. Concerning priority of approach, we agreed with Rajasekaran that priority of approach depended on the flexibility of the lesion. Postural reduction in prone position and posterior approach should be considered as first priority in reducible deformity patient rather than the anterior approach⁽²¹⁾.

Combined anterior and posterior approaches can be performed with either a one or two-stage procedure. The one-stage procedure has the advantages of decreased hospital admission time, early ambulation, and decreased number of anesthesia. The two-stage procedure can provide time for patients to recover for the second operation^(20,22). Although the present study could not find any significant difference in operative time between the one-stage procedure and the two-stage procedure, the total blood loss in the one-stage procedure was less than the two-stage

procedure. Graft dislodge is the complication that should be considered if the anterior procedure is carried out first in the two-stage procedure. For one patient in our series, the rest period between the first and the second operation was an important factor relating to graft dislodge. If the first approach is the anterior approach, the one-stage procedure might be a better choice than the two-stage procedure. Therefore, a proper sized graft should be used to replace the deficiency in the anterior column and this may help to decrease the chances of graft dislodgement during the resting period in the two-stage procedure⁽²³⁾.

Kyphotic correction in multilevel spinal tuberculosis in our study has shown good correctable of the kyphotic angle and maintenance of the corrected kyphotic angle. The average of immediate postoperative correctable angles was 19 degrees (range 0-50) and the average of final kyphotic angles after combined approaches was 4 degrees (range 0-11). These results support the benefit of combined approaches for prevention of progressive kyphosis in multilevel spinal tuberculosis patients.

The major limitation of the present study was a small number of patients, and this retrospective review may have missed some patients who had minor complications. In addition, our study was designed to evaluate the outcome of single technique; there was no comparable group of other techniques. Finally, the authors included all age groups, which may be different in physiologic conditions and response for treatments.

Conclusion

Combined posterior instrumentation and anterior interbody fusion are effective in the management of multilevel spinal tuberculosis, as this procedure can effectively eradicate infection, provide bony fusion, correct deformity, and prevent the progression of kyphosis. The one-stage procedure is attractive for the combined approach, if the patient's condition permits doing so.

Potential conflicts of interest

None.

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ผลการรักษาผู้ป่วยวัณโรคกระดูกสันหลังที่เป็นหลายระดับด้วยวิธีการผ่าตัดยึดตรึงกระดูกสันหลังเข้าทางด้านหลังร่วมกับการผ่าตัดเชื่อมกระดูกสันหลังเข้าทางด้านหน้า

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ภูมิหลัง: ในการรักษาผู้ป่วยวัณโรคกระดูกสันหลังที่เป็นหลายระดับ นอกจากการใส่ยาในการรักษาแล้วมีการนำเสนอ การรักษาด้วยวิธีการผ่าตัดยึดตรึงกระดูกสันหลังเข้าทางด้านหลังร่วมกับการผ่าตัดเชื่อมกระดูกสันหลังเข้าทางด้านหน้า แต่การศึกษาผลลัพธ์ของการผ่าตัดรักษานี้ยังมีน้อย

วัตถุประสงค์: ศึกษาผลการรักษาผู้ป่วยวัณโรคกระดูกสันหลังด้วยการผ่าตัดด้วยวิธีการผ่าตัดยึดตรึงกระดูกสันหลัง เข้าทางด้านหลังร่วมกับการผ่าตัดเชื่อมกระดูกสันหลังเข้าทางด้านหน้า

วัสดุและวิธีการ: ทำการศึกษาในผู้ป่วย 11 รายที่มีจำนวนข้อที่ติดเชื้อวัณโรคกระดูกสันหลังมากกว่า 1 ระดับ ผู้ป่วย 4 รายมีการติดเชื้อ 3 ระดับและผู้ป่วย 7 รายมีการติดเชื้อ 2 ระดับ โดยทำการผ่าตัดเข้าทั้งทางด้านหน้าและด้านหลัง ในครั้งเดียวกันจำนวน 8 ราย อีก 3 รายทำการผ่าตัดโดยแบ่งการเข้าผ่าตัดเป็น 2 ครั้ง ระยะเวลาติดตามผู้ป่วยนานโดยเฉลี่ย 16 เดือน (7-33 เดือน)

ผลการศึกษา: ผลที่ได้น่าพอใจเกิดจากรูปตัวของกระดูกสันหลังดีขึ้นจาก 40 องศา เป็น 19 องศา หลังผ่าตัดช่วงแรกและเป็น 23 องศา หลังสิ้นสุดการรักษาผู้ป่วยเกือบทุกรายหายจากวัณโรคกระดูกสันหลังยกเว้นผู้ป่วย 1 ราย ที่กินยาไม่ครบตามที่กำหนดทำให้มีผลและหนองที่หลังเรื้อรัง นอกจากนี้มีผู้ป่วย 1 รายที่มีปัญหากระดูกที่เชื่อมหลุดจากตำแหน่งที่ผ่าตัดแต่ไม่ได้มีอาการผิดปกติ

สรุป: การรักษาผู้ป่วยวัณโรคกระดูกสันหลังด้วยการผ่าตัดด้วยวิธีการผ่าตัดยึดตรึงกระดูกสันหลังเข้าทางด้านหลัง ร่วมกับการผ่าตัดเชื่อมกระดูกสันหลังเข้าทางด้านหน้าได้ผลการรักษาดี
