

Epidemiology Research

The outcome of posterior instrumented fusion in spinal tuberculosis

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ABSTRACT

ABSTRAK

Introduction: Spinal tuberculosis can cause serious morbidity and deformity. Treatment ranging from antituberculosis drugs to surgical, and the combination thereof. In the present study, authors have shown the results of posterior decompression and posterior stabilization (PDPS) only. The purpose of this retrospective study is to evaluate the clinical and radiologic outcomes of spinal tuberculosis treated with PDPS only.

Methods: This retrospective study reviewed twenty two patients with thoracic, thoracolumbar and lumbar tuberculosis who were treated with PDPS only. There were seven males and fifteen females with a mean age of 39.3 ± 15.4 years. The mean follow-up period was 22.6 ± 13.4 months and the minimum duration of follow up was 12 months. Clinical outcomes (Visual Analog Scale/VAS, Short Form 36/SF-36, Oswestry Disability Index/ODI, Frankel) and radiologic results were analyzed.

Results: The infection was resolved in all patients with no recurrence and we found no complication, intra-operative or post-operative. Mean VAS score decreased from 8.9 to 1.3 and mean ODI score also decreased from 78.9 to 10.7. The patients's physical and mental health outcomes were improved using SF-36 survey instrument. There were significant neurologic improvement at the final follow-up based on Frankel classification. The mean kyphotic angle pre-operatively was 22.6 ± 15.7 degree which corrected to a mean of 14.9 ± 8.0 degree with mean loss of correction of 2.8 degree at the final follow up. Fourteen (63.6%) cases achieved bony fusion.

Conclusion: PDPS only is a safe and effective procedure for treating spinal tuberculosis, with good improve-ment in clinical and radiologic outcomes.

Pendahuluan: Tuberkulosis tulang belakang dapat menyebabkan morbiditas dan deformitas yang berat. Penanganan mulai dari obat-obatan antituberkulosis sampai ke pembedahan, dan kombinasi. Pada studi ini, peneliti melaporkan hasil dari tindakan dekompresi posterior dan stabilisasi posterior saja. Tujuan dari studi retrospektif ini adalah untuk mengevaluasi luaran klinis dan radiologis pasien tuberkulosis tulang belakang yang ditangani dengan dekompresi posterior dan stabilisasi posterior saja.

Metode: Penelitian ini menilai dua puluh dua pasien dengan tuberkulosis thorakal, thorakolumbal dan lumbal yang ditangani dengan dekompresi posterior dan stabilisasi posterior saja. Didapatkan rerata usia 39.3 ± 15.44 tahun dengan 7 orang laki-laki dan 15 perempuan. Periode evaluasi rerata 22.6 ± 13.4 bulan dan jangka waktu evaluasi minimal adalah 12 bulan. Dilakukan penilaian luaran klinis (Visual Analog Scale/VAS, Short Form 36/SF-36, Oswestry Disability Index/ODI, Frankel) dan hasil radiologi.

Hasil: Infeksi teratasi pada semua pasien tanpa kejadian rekurensi dan tidak ditemukan komplikasi sewaktu dan sesudah operasi. Rerata nilai VAS menurun dari 8.9 menjadi 1.3 dan rerata nilai ODI juga menurun dari 78.9 menjadi 10.7. Luaran kesehatan fisik dan mental pasien yang diukur dengan alat survey SF-36 mengalami peningkatan. Terdapat peningkatan neurologis sewaktu evaluasi akhir dengan klasifikasi Frankel. Rerata sudut kyphotic sebelum operasi 22.6 ± 15.7 yang dikoreksi menjadi 14.9 ± 8.0 derajat dengan rerata loss of correction 2.8 derajat pada waktu evaluasi akhir. Empat belas (63.6%) kasus mengalami bony fusion.

Kesimpulan: Prosedur dekompresi posterior dan stabilisasi posterior saja aman dan efektif untuk penanganan tuberkulosis tulang belakang, dengan peningkatan luaran klinis dan radiologis.

Keywords: posterior decompression, posterior stabilization, spinal tuberculosis

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INTRODUCTION

Tuberculosis is an old disease and is still the leading cause of death in the world. Tuberculosis prevalence in Indonesia and other developing countries is quite high.¹ The five countries that stood out as having the largest number of incident cases in 2016 were (in descending order) India, Indonesia, China, the Philippines and Pakistan, which together accounted for 56% of the global total. Of these, China, India and Indonesia alone accounted for 45% of global cases in 2016.

The World Health Organization reported that the incidence of tuberculosis in Indonesia (2016) is 1.020.000 cases or 391 per 100.000 population.² The spine is involved in 50% of the osteoarticular tuberculosis cases. Spinal tuberculosis is the most dangerous form, as it may cause destruction of the vertebral body, spinal deformity and/or paraplegia and pulmonary insufficiency secondary to the deformity of the thoracic cage.³ Though many patients can be cured by chemotherapy, surgery is frequently imperative for spinal decompression and deformity correction.⁴ Surgical management of

tuberculosis of the spine has evolved considerably, since 1895 when Me'nard decompressed tubercular abscess around the spinal cord with gratifying results. Posterior spinal fusion with bone grafting alone was introduced in 1911 by Hibbs and Albee. Anterior radical debridement and non-instrumented fusion was described by Ito and Asami in 1934 followed by Hodgson and Stock in 1956. Two reports of isolated anterior instrumented fusion have been published where the authors have claimed good results. However, other authors have reported good outcomes with posterior fusion. Guven, *et al.* reported good results with isolated posterior instrumentation and fusion even without anterior debridement. Garst reported that anterior debridement alone was insufficient and the best results were achieved by combining posterior fusion with anterior debridement. Anterior spinal surgery is not without complications. Some authors have considered anterior approach to be too invasive and often unnecessary in the context of spinal tuberculosis. Various methods have been described for spinal tuberculosis treatment. Posterior instrumented stabilization followed by chemotherapy seems to be adequate for obtaining satisfactory healing of the lesions.⁵ In North Sumatera-Indonesia, most of the surgery treatment of spondylitis tuberculosis is using the posterior approach only, but until now, there is no data can explain the clinical and

radiological out-comes of spondylitis tuberculosis in patients after posterior instrumented fusion. The purpose of this study is to investigate the clinical and radiological outcomes of posterior debridement and posterior stabilization (PDPS) only in spinal tuberculosis.

METHODS

This retrospective study was conducted at Medical Faculty of North Sumatera University-Indonesia. Diagnosis of spinal tuberculosis was made from history, laboratory (complete blood counts, erythrocyte sedimentation rate/ESR and C-reactive protein/CRP, Mantoux tuberculin test) and imaging, including X-ray and MRI. Patients had four drugs regimen (Rifampicin, INH, Pyrazinamid, Ethambutol) for at least two weeks before surgery, continued for 2 months after surgery, followed by two drugs regimen (Rifampicin and INH) for 10 months. Selection of patients for surgery was done using the "middle path regime" of Tuli as a guide.⁵ Surgery was considered in the presence of the following indications: (1) persistent marked pain despite chemotherapy for 2 months, (2) significant vertebral body destruction or kyphosis at the time of initial presentation, and (3) progression of neurological deficit or appearance of fresh deficit during treatment with chemotherapy. Subjects included in the study were 22 patients (7 males and 15 females) with thoracic, thoracolumbar and lumbar spinal TB underwent PDPS with pedicle screws and rods between November 2013 to November 2016. Histopathology and culture sensitivity of the biopsy sample were done in all cases post-operatively to confirm the diagnosis. Patients were advised to use brace for a minimum period of 3 months post-operatively and to comply with the chemotherapy to ensure healing of the lesions. Mean age at the time of surgery was 39.3 years (ranging from 17-67 years). Mean follow up period was 22.6 months with minimum follow up 12 months. Patients were excluded if the histopathology was not consistent with the clinical and radiologic diagnosis, and had cervical or sacral TB. The following clinical outcomes were evaluated before and after surgery and at the final follow up using Visual Analog Scale (VAS) scores for pain, Short Form 36 (SF-36) which was divided into 8 groups, including physical function (PF), physical health (PH), emotional problem (EP), energy/fatigue (ENE), emotional well being (EMO), social function (SF), general health (GH), and health change (HC); Oswestry Disability Index (ODI), Frankel for neurological assessment; and kyphotic angle for radiologic outcome. The angle of kyphosis was

calculated from the x-rays by the method described by Konstam and Blesovsky (Figure 1) from plain standing lateral-view films (except in those who were unable to stand).⁶

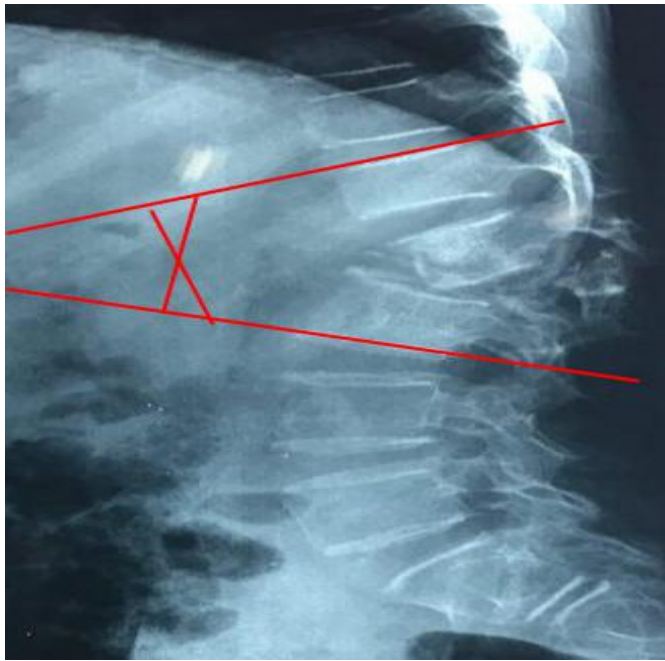


Figure 1. Radiologic assessment of Konstam's angle. It is measured by the angle formed from perpendiculars drawn to the lines along the superior border of the cranial normal vertebra and the inferior border of the caudal normal vertebra.⁶

Loss of correction was calculated as difference between post-operative and final follow-up kyphotic angle. Beside kyphotic angle measurement, radiographs were taken to see alignment of the spinal column, fusion and position of the implants. The clinical and radiologic evidences of bony fusion were defined as the absence of correction loss, instrumentation failure, and the presence of trabecular bone bridging between the bone grafts and the vertebrae.⁴ A paired *t*-test or Wilcoxon signed rank test, in cases of nonparametric data, was used for evaluating VAS scores, SF-36, ODI scores, and kyphotic angles measured pre-operative, post-operative and at the final follow-up. Data were checked using Saphiro Wilk to know the distribution of this study. The statistical significance level was set at $p < 0.05$. All statistical calculation were performed using computer based statistic program. The study was approved by the Health Research Ethical Committee of Medical Faculty of North Sumatera University and informed consent was obtained from all subjects.

RESULTS

The infection was resolved in all patients with no recurrence. No upper thoracic spine T1–T4 was involved in our study, 3 cases in the middle thoracic spine T5–T8, 10 cases in the lower tho-racic spine D9–D12, and 7 cases in thoracolum-bar and lumbar. Two patients had multiple level involvement. No patient were suffering from ma-jor medical illness and we found no complication intraoperative or post-operative in our study. Pa-tient demographics and characteristics are shown in the Table 1. Twenty-two patients (15 females and 7 males)

Table 1. Characteristics and demographics distri-bution of 22 spinal tuberculosis patients

Variable	Total
Female, n (%)	15 (68,2%)
Male, n (%)	7 (31,8%)
Youngest age	17 years
Oldest age	67 years
Mean age	39,3 ± 15,4 years
Mean follow up	22,6 ± 13,4 months
Fusion	14 (63,6%)
No fusion	8 (36,4%)

Table 2. Frankel grading of patient before surgery and at final follow up

Frankel grade (preoperative)	Frankel grade (final follow-up)				
	A	B	C	D	E
A		1			2
B				1	3
C					2
D				1	8
E					4

At the final follow-up, there was only 1 patient with Frankel B, her age was 18 years and she was able to mobilize between bed and wheelchair independently. There were only 2 patients with Frankel D, one was improved from Frankel B before surgery and another one with no improve-ment. Nineteen patients were improved to Frankel E. All patients with neurological deficit showed improvement in Frankel grading at the final follow up and no deterioration of neurologic status was found. (Table 2).

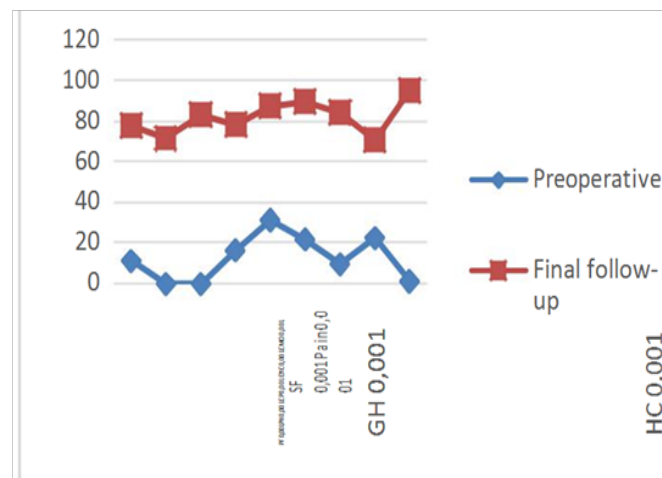
Mean VAS score improved from $8,89 \pm 1,89$ before surgery to $1,32 \pm 0,99$ at the final follow-up. ODI also improved from very serious disability before surgery to minimal disability at the final follow-up. Table 3 summarizes the changes in the clinical and radiological outcomes preoperatively and at the final follow-up.

Table 3. Clinical and radiologic outcomes preoperatively and at final follow-up

Vrbl	Before	Final follow-up	p value
VAS	$8,89 \pm 1,89$	$1,32 \pm 0,99$	0,001
ODI	$78,9 \pm 19,6$	$10,7 \pm 16,5$	0,001
KYP	$22,6 \pm 15,7$	$17,7 \pm 9,4$	0,008

Vrbl, Variable; **ODI**, Oswestry Disability Index; **VAS**, Visual Analog Scale; **KYP**, Kyphotic

Mean preoperative kyphotic angle was $22,6 \pm 15,7$ degree which was corrected to a mean of $14,9 \pm 8,0$ degree with average correction of 7,7 degree (34,1%). There was a small degree of loss of kyphotic correction in the early post-operative period with an average of 2,8 degree, but the correction remained stable at the final follow-up and did not alter the bone healing.



PF, Physical Function; **PH**, Physical Health; **EP**, Emotional Problem; **ENE**, Energy/Fatigue; **EMO**, Emotional Well Being; **SF**, Social Function; **GH**, General Health; **HC**, Health Change

Figure 2. Mean SF-36 score preoperative and at the final follow-up

From Figure 2, it is obviously seen that there was improvement in the mean score of the 9 indicators of SF-36 at the final follow-up. It means that this method of

surgery is success to improve the quality of life in spinal tuberculosis patients.

DISCUSSION

Pott's disease is the most common granulo-matous bacterial infection of the spine and the most common bone TB.⁷ The application of antituberculosis drugs is the basis of the treatment of spinal tuberculosis.⁸ The aims of treating spinal TB are to eradicate the infection, prevent or improve neurological deficits, correct kyphosis, maintain normal sagittal alignment of the spine, and early return to activities of daily living.⁶ Approach for surgical treatment of thoracolumbar tuberculosis has always been controversial.⁹ A variety of approaches are used in the surgical treatment, including anterior, posterior, and combined anterior with posterior instrumentation.⁶ Combined anterior radical debridement and arthrodesis has some advantages, including direct access to, and excision of, the focus of disease, rapid bony union, and less progressive kyphotic collapse. In contrast, posterior fusion with rigid instrumentation is safer, technically easier and avoids the potential of intra- and post-operative complications which can be associated with the anterior approach. Although the epidural abscess associated with lumbar tuberculous spondylitis is usually anterior, in cases of epidural suppuration, access to the neural elements can be limited if an anterior approach is used.¹⁰ In 1960, Hodgson, *et al.*, first reported the Hong Kong operation to treat spinal TB. Bailey, *et al.*, also reported satisfactory outcomes in 100 patients underwent anterior debridement and instrumentation.¹¹ Zhang, *et al.*, indicated that one-stage posterior approach obtained more satisfactory outcome than posterior plus anterior approach surgery in minor surgical invasion and less procedure-related complications.⁴ In our study at North Sumatera-Indonesia, we carried out PDPS only with pedicle screws. Beside familiarity to the technique, we prefer posterior approach because it is more simple, less invasive with low complication rate. Jain, *et al.*¹² reported that significant improvement in neurological grading was evident with an improvement of two grades in more than 50% of cases, similar with our findings. Zhou, *et al.*¹³ compared the results of three approaches for the treatment of lumbar tuberculosis and three of them showed no big difference in neurologic recovery. VAS score in our study improved (pre-operative 8.89 ± 1.89 /final follow-up 1.32 ± 0.99) comparable with Jain[12] (preoperative 8.7 ± 0.55 /final follow-up 1.4 ± 0.63). Zhou, *et al.*¹³ also reported that there was no big difference of improvement

in the VAS score between the anterior group (pre-operative 6.2 ± 1.2 /post-op 2.6 ± 1.0) and posterior group (pre-operative 6.1 ± 1.1 /post-op 2.9 ± 0.9). In this study, the mean kyphotic correction was 7.7 degree with loss of correction 2.8 degree and 63.6% fusion comparable to Sahoo study¹⁴ with kyphotic correction of 8.3 degree with loss of correction 2.2 degree and 55% fusion. In the present series, ODI score improved, this was similar to the study of Singh, *et al.*⁷ Zhou, *et al.*¹³ reported that the ODI score improved in three groups of approach with no significant difference. Final follow-up of SF-36 score for physical function, physical health, emotional problem, energy/fatigue, emotional well being, social function, general health, health change were higher than pre-operative scores, this is consistent with the study of Li, *et al.*⁸ Campbell, *et al.* have reported higher rates of complications with isolated anterior fixation and combined anterior and posterior spinal fusion in comparison to isolated posterior fusion.¹² In our experience, PDPS only has been proven to relieve pain, improve neurological status, correct and prevent deformity. This method also brings good result in reducing patient's disability caused by the pain and the neurologic deficit which were measured with ODI score and improved physical health, emotional and social function which showed with SF-36 score. This method also less invasive with less surgical risk and complication. Although the results from this study showed better result at the final follow-up, this is only a short-term follow-up, larger samples and longer term of follow-up are required to ensure that there is no complication or recurrence of the disease.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

CONCLUSION

PDPS only is a safe and effective procedure for treating spinal tuberculosis, with good improvement in clinical and radiological outcomes. This procedure has been proven to relieve pain, improve neurological status, correct and prevent deformity, and improve the quality of life. This method also less invasive with less surgical risk and complication. Clinical trials with a larger sample size and a longer follow-up period are required.

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