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The Role of Debridement and Spinal Fusion on Frankel Grade, ESR Levels, and CRP in Tuberculosis Spondylitis at Dr. M. Djamil General Hospital, Padang, Indonesia

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ABSTRACT

Background: The surgical strategy in the full management of spinal tuberculosis is to debride the tuberculous infection lesion with debridement adequate treatment, reduce symptoms of compression of nerves with adequate decompression, promote the improvement of nerve function, correct kyphosis and prevent deformity, and rebuild spinal stability. This study aims to evaluate the management of debridement and spinal fusion for clinical improvement as assessed by Frankel grade and improvement of laboratory features as assessed by ESR and CRP. **Methods:** This study is an observational study with a cross-sectional approach which was conducted on 34 research subjects using secondary data. Univariate and bivariate data analysis was conducted to explore the role of debridement and spinal fusion on Frankel grade and ESR and CRP levels. **Results:** Clinical improvement was seen pre and postoperatively related to Frankel grade. The majority of research subjects experienced improvement based on the Frankel grade, ESR and CRP levels. **Conclusion:** The action of debridement and spinal fusion plays a role in clinical improvement based on Frankel grade and laboratory improvement based on ESR and CRP values.

1. Introduction

Spinal tuberculosis (Pott's disease) is one of the skeletons involved in extrapulmonary tuberculosis. In skeletal involvement in areas with a high burden of tuberculosis, the incidence is getting higher. It is estimated that 10% of patients with pulmonary tuberculosis have skeletal system involvement. Meanwhile, spinal involvement occurs in approximately 1% of patients with tuberculosis, being the most dangerous and most common skeletal

involvement, which is 50% of all skeletal involvement in extrapulmonary tuberculosis, followed by the hip and knee bones.^{1,2} The increasing frequency of TB in developed and developing countries has resulted in spinal TB becoming one of the health problems.³ The severity of the neurological deficit experienced by spinal tuberculosis patients is a consideration in determining the management that will be undertaken by the patient. The management of spinal tuberculosis

is difficult and challenging in determining the decision-making process due to the lack of literature and guidelines on optimal management and management strategies.⁴ If the patient with spinal tuberculosis can be diagnosed early, the patient can be treated with medical therapy, one of which is using triple-drug anti-tuberculous chemotherapy. Which is typically used for 9–18 months, but making a definitive diagnosis of spinal tuberculosis is not easy due to the slow and late progression of the disease. Due to difficulties in early diagnosis of disease, patients often receive therapy that is not in accordance with the disease, such as non-steroidal anti-inflammatory drugs, corsets, and physical therapy in medical rehabilitation, compared to finding out the truth of the diagnosis and managing it adequately.^{5,6}

The surgical strategy in the full management of spinal tuberculosis is to debride tuberculous infectious lesions with adequate debridement, reduce symptoms of nerve compression with adequate decompression, promote the improvement of nerve function, correct kyphosis and prevent deformity, and rebuild spinal stability. Until now, there are several surgical therapy techniques in the literature that are used in the management of spinal tuberculosis, one of which is spinal fusion and debridement, but there is no consensus regarding the optimal surgical treatment method for spinal tuberculosis.^{1,6,7} This study aims to evaluate the management of debridement and spinal fusion for clinical improvement as assessed by grade Frankel and improvement in laboratory features assessed by ESR and CRP.

2. Methods

This study is an analytical observational study with a cross-sectional approach to assessing the management of debridement and spinal fusion on clinical improvement as assessed by Frankel grade and improvement of laboratory features assessed by

ESR and CRP. A total of 34 subjects participated in this study, where subjects of this study met the inclusion criteria, namely all TB spondylitis patients who were treated and underwent spinal fusion and debridement surgery at Dr. M. Djamil General Hospital, Padang for the period 1 April 2022 - 30 June 2022. This study used secondary data. Sourced from the patient's medical record. This study has received approval from the research ethics committee of Dr. M. Djamil General Hospital, Padang, Indonesia No. LB.02.02/5.7/256/2022.

Assessment of clinical improvement was carried out by grade Frankel, and laboratory improvement was carried out by assessing the levels of ESR and CRP. The data collected were statistically analyzed using the SPSS version 25 computer program. Univariate analysis was intended to describe each research variable so that the distribution and percentage of each variable were presented in the form of tables and graphs. The numerical value of the clinical outcome examination results will be averaged and SD. The data will be tested for normality using the Shapiro-Wilk test. The statistical analysis used if the data is normally distributed is the paired T-Test, but if the distribution data is not normal, the analysis used is the Wilcoxon test. A difference is considered significant if the P value <0.05.

3. Results

In table 1, it can be seen that Frankel E increased from 2.9% to 85.3%, with Frankel's more severe degrees all experiencing a decrease, namely Frankel D from 47.1% to 11.8%, Frankel C and B, respectively, from 32.4% and 2.9% to 0, and finally Frankel A from 14.7% to 2.9%. Table 1 also shows that grades of Frankel C and D are the most common initial grades that change to Frankel E after surgery, with Frankel C being all E (11 samples) and Frankel D being E as many as 12 samples.

Table 1. Comparison of pre and post-operative debridement and spinal fusion against Frankel grade on TB spondylitis at Dr. M. Djamil General Hospital, Padang.

Grade	Pre-operative n(%)	Post-operative n(%)
Frankel A	5 (14.7)	1(2.9)
Frankel B	1(2.9)	0(0)
Frankel C	11(32.4)	0(0)
Frankel D	16(47,1)	4(11,8)
Frankel E	1(2,9)	29(85,3)

In table 2, it can be seen that there is an effect of debridement and spinal fusion on ESR levels in TB

spondylitis statistically with a p-value of 0.005 with a decrease from 55.44 ± 35.73 to 43.00 ± 29.00 .

Table 2. Comparison of pre and post-operative debridement and spinal fusion on ESR levels in TB spondylitis at Dr. M. Djamil General Hospital Padang.

ESR	Mean \pm SD	p-value*
Pre-operative	55.44 ± 35.73	0.005
Post-operative	43.00 ± 29.00	

*T-test dependent

In table 3, it can be seen that there is an effect of debridement and spinal fusion on CRP levels on TB spondylitis statistically with a p-value of 0.000, where

overall, there was a decrease in the mean CRP levels before the procedure from 43.02 ± 34.34 to 19.82 ± 27.20 after the procedure.

Table 3. Comparison of pre and post-operative debridement and spinal fusion on CRP levels in TB spondylitis at Dr. M. Djamil General Hospital Padang.

CRP	Mean \pm SD	p-value*
Pre-operative	43.02 ± 34.34	0.000
Post-operative	19.82 ± 27.20	

*Wilcoxon Test

4. Discussion

The results of this study are in line with a study conducted on 247 patients, which compared outcomes in TB spondylitis patients who underwent debridement and bone fusion with an anterior-

posterior vs. posterior-only approach. At pre-operative time 11 patients had Frankel Grade B, 25 grade C, 42 grade D patients, and 32 patients had grade E neurological function that was normal. Improved after surgery. At the final follow-up, 2 patients had grade C,

12 patients had grade D, and 96 patients had grade E Frankel function.⁸ Another study conducted a study on 39 patients with tuberculous spondylitis and divided the study patients based on the vertebral damage that occurred and their general condition, consisting of patients in the extensive group who had extensive vertebral damage but relatively good general condition consisting of patients who received transforaminal and interbody debridement. Fusion, while transpedicular decompression, was performed in a limited group of patients with less extensive vertebral damage but with serious medical records. Fast recovery is an improvement of at least one degree Frankel within 6 weeks after surgery and vice versa. At the final follow-up, all 39 patients in both groups showed improvement in neurological function and did not show any decline. With regard to the type of procedure, particularly at the thoracic and thoracolumbar vertebrae, patients who underwent extensive surgery had a significantly rapid Frankel/neurological recovery in contrast to limited surgery.⁹

Another study found that all patients had pre-operative neurologic impairment (Frankel Grade C or D). At the most recent follow-up, 82 patients had neurofunctional parameters within the normal range. However, significant differences were found between the neurofunctional parameters before surgery and at the final follow-up ($P < 0.05$).¹⁰ Another study showed that patients diagnosed with paraparesis due to tuberculous spondylitis at L4-S1 level with a paravertebral abscess at L4-S1 Frankel D underwent anterior debridement and fusion. The patient was given intensive four-drug therapy for two months, including isoniazid (H), rifampin (R), ethambutol (E), and pyrazinamide (Z), followed by two-drug therapy (RH) for a continuation phase of 4 months. Patients were followed up physically and radiographically at one, three, six months, and one year after surgery. Post-operative radiographs show optimal recovery of the vertebrae and removable mesh. Three months and six months, and one year of post-operative follow-up showed good functional results and fusion signs from

X-ray and CT.¹¹

Another study also showed the same thing in 37 study patients with tuberculous spondylitis who underwent modified posterior trans face debridement, and interbody fusion after posterior instrumentation, under the protection of anti-tuberculosis chemotherapy for 18 months. The patients were evaluated preoperatively and postoperatively in terms of Frankel scores. Follow-up time was 29-50 months, and no post-operative complications or recurrence of spinal tuberculosis were observed. Definitive bone fusion was achieved in all patients. At the final follow-up, 2 cases were graded as Frankel grade D, 35 as grade E.¹² Another study showed that among 15 cases of secondary deformity, post-operative after spinal tuberculosis treatment was enrolled. There were 8 recurrences of spinal tuberculosis. Anterior instrumentation was used in 9 patients, and posterior instrumentation in 6 patients. Clinical and radiographic data from before and after previous surgery, before and after revision surgery, and after a follow-up of at least 9 months were reviewed retrospectively. At the end of the follow-up period, All patients experienced an improvement in Frankel's grade, namely grade E. No neurological complications were observed during or after revision surgery. No internal wound infection. No instrumentation complications or recurrence of spinal tuberculosis were found at the last follow-up.¹³ Another study of 20 patients with spinal tuberculosis grade Frankel paraplegia A/B and Frankel paraplegia C/D had received 4 FDC (fixed drug combination) therapy for 6 weeks but did not respond to the anti-tuberculosis drugs. All patients underwent surgical methods.

Based on the results of the examination at the time of re-monitoring, all patients experienced clinical neurological improvement. A total of 11 patients (55.0%) experienced neurological improvement to Frankel E, and 9 patients (45.0%) experienced neurological improvement to Frankel D. This shows superior results in debridement and spinal fusion and shows minimal surgical risk.¹⁴ The results of this study showed that there were 2 patients who did not

experience a change in post-operative Frankel grade. In another study, there were patients until the end of the follow-up period, but there were still a small number of patients who did not experience a change in Frankel grade. Treatment of spinal tuberculosis should be based on the use of effective anti-TB drugs, and early surgical debridement and decompression play an important role in treating patients with severe pain and/or marked neurological impairment. The reason for the possibility of minimal correction resulting in not-so-optimal post-operative functional changes (unchanged Frankel grade) is that the TB lesion may not be confined to one segment, and the placement of a pedicle screw is attempted to be placed within the pathological vertebral body pedicle to reduce the fixation rate, and also retains more segments of motion at the lumbar level. The longer total duration of surgery and higher blood loss also affected the outcome. Long-segment instrumentation and posterolateral fusion can successfully obtain such stability that the spinal cord or nerve roots are not irritated and can promote efficient neurologic recovery, thereby increasing inpatient mobility and reducing bedside complications. Extensive clearance of caseous tissue leading to an inflammatory response is correlated with rapidly developing restoration of function. Finally, a sudden reduction in inflammation of the neural elements was associated with increased disease activity and neurological assessment.¹⁵ Degrees of post-operative Frankel is influenced by several things. Another study presented the level of spinal involvement, assessment of AIS in presentation, bladder and bowel involvement, and duration of disease were significantly correlated with the degree of neurologic improvement in patients after surgery.¹⁶ In addition, another study reported the risk of post-operative infection in spinal tuberculosis patients, which could interfere with the rate of neurological healing. The increased infection rate is likely the result of surgical procedures, blood loss, and tissue damage. Many of the underlying risk factors for this include drug or alcohol abuse, malnutrition, and smoking.¹⁷ Spinal fusion debridement has the best effect on TB

spondylitis compared to spinal trauma. Other studies suggest that spinal fusion in vertebral trauma is not associated with significant improvements in clinical outcomes such as pain, function, and quality of life and that spinal fusion is associated with a longer operating time with more blood loss and complications.¹⁸ Whereas, posterior fusion debridement in spondylitis can provide satisfactory clinical and radiological outcomes with fewer injury rates, shorter operating times, shorter hospital stays, and lower costs.¹⁹

The results of this study are also in line with other studies, which compared two surgical methods for tuberculous spondylitis, namely one-stage posterior unilateral limited laminectomy and bilateral laminectomy debridement and bone grafting fusion combined with internal fixation. Preoperative CRP was 43.2 ± 18.1 mg/l and 47.0 ± 16.6 mg/l, respectively. CRP values in all patients returned to normal levels six months after surgery.²⁰ These results are also in line with other studies in which 17 patients with lower cervical level tuberculous spondylitis underwent anterior debridement, decompression, fusion, and instrumentation. An anterior approach is easier to perform to expose the impacted segment directly and reduce spinal cord compression adequately. In the study, all patients with lower cervical tuberculous spondylitis recovered with normal ESR and CRP levels and showed no signs of recurrence or spread of TB at follow-up. The favorable outcome can be attributed to a greater operating field. In contrast to tuberculous spondylitis at the thoracic and lumbar levels, anterior debridement can impair anterior growth and limit the remodeling capacity of the spine. All study patients were followed up for 45.5 ± 12.9 months. ESR and CRP decreased gradually after surgery and returned to normal at the final follow-up in all patients. The mean pre-operative ESR was 40.4 ± 22.7 mm/hour, which became normal at the final follow-up (mean 15.7 ± 7.1 mm/hour). The mean pre-operative CRP was 30.6 ± 32.6 mg/L, which returned to 15.8 ± 11.1 mg/L at follow-up.²¹

5. Conclusion

Debridement and spinal fusion play a role in clinical improvement based on Frankel grade and laboratory improvement based on ESR and CRP values.

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