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Management of Primary Spondylodiscitis: Clinical Outcome of a Series of Twenty–Seven Patients

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ABSTRACT

Background Data: Spondylodiscitis is a major clinical condition with significant health and economic burden. There is a controversy regarding the use of conservative therapy with systemic antibiotics alone versus combined with surgery to manage primary spondylodiscitis.

Study Design: Retrospective clinical case study.

Purpose: To assess the clinical outcome of treatment of the patients with primary spondylodiscitis.

Patients and Methods: This study was conducted on 27 patients with primary spondylodiscitis. There were 17 males and 10 females. The mean age was 49.96 ± 9.83 years. All the patients presented with local pain over the involved vertebral level. The clinical outcomes were assessed using the Visual Analogue Scale (VAS), ASIA score, and Kirkaldy-Willis functional outcome criteria.

Results: Eight patients (29.6%) were managed by medical treatment alone. Nineteen patients (70.4%) were managed surgically, including seven patients who were operated on by laminectomy and 12 patients by posterior decompression and fusion, followed by subsequent treatment with antibiotics. VAS score was reduced significantly in the patients treated surgically compared with the patients treated medically at 1 and 3 months (*P* value < 0.001 and = 0.010, respectively) but not at 6 and 12 months of the follow-up period (*P* value = 0.235 and 0.886, respectively). There was no significant difference between the two groups regarding CRP and ESR reduction levels, the functional outcome, and the complications at different time intervals.

Conclusion: Posterior decompression with or without fusion was more effective than medical treatment in reducing the pain in patients with primary spondylodiscitis at 1 and 3 months of the follow-up period without influencing the final clinical outcome. (2021ESJ230)

Keywords: Spondylodiscitis, Spinal decompression, Infection, Spinal fusion, Medical treatment

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INTRODUCTION

Spondylodiscitis is an infection of the intervertebral disc space and adjacent vertebral endplates.[30] It has an annual incidence of about 5–6/100,000 patients and the incidence of new cases is increasing in recent decades. The diagnosis of spondylodiscitis is based on a combination of clinical, laboratory, and radiological indicators. Most patients with spondylodiscitis present initially with nonspecific back pain and usually have a significant delay between diagnosis and treatment initiation.[5] *Mycobacterium tuberculosis* is the most common pathogen worldwide, yet brucellosis is prevalent in Mediterranean countries and the Middle East.[6] Although antibiotic therapy is the standard treatment for most cases of spondylodiscitis, there is a controversy about whether antibiotic treatment should be used alone or combined with surgery.[23] Different surgical approaches were employed for the treatment of spondylodiscitis.[25] Few reports have discussed treating spondylodiscitis with the posterior approach only.[2,13,14,19,29] The clinical outcomes following the treatment of spondylodiscitis had been reported sparingly using various metrics. Only two studies have reported the Visual Analogue Scale (VAS) at the patients' last follow-up as a mean to compare the outcomes in the surgical and medical patients.[20,26]

This study assesses the clinical outcomes of a series of patients treated with primary spondylodiscitis and reports the pain outcomes at the last follow-up.

PATIENTS AND METHODS

This retrospective clinical case study has been conducted on 27 patients with primary spondylodiscitis from July 2014 to July 2018. We reviewed our hospital medical records for all patients treated and managed either medically or surgically for spontaneous spondylodiscitis during this period. All patients who underwent treatment in our facilities with complete clinical, laboratory, radiological, contact, and follow up data were reported. Patients presenting with postspinal surgery discitis, those with incomplete data, or those lost during the outpatient follow-up were excluded from the study. The study was approved by our institutional review board, and all patients formally consented before enrollment in our therapy protocol.

The diagnosis of primary spondylodiscitis was based on clinical, laboratory, and radiological criteria. All patients were subjected to medical history taking, general and neurological examinations, and laboratory and radiological investigations. Moreover, a complete medical history was obtained, including history of low back pain, fever, and weight loss. The back pain was assessed using VAS. The American Spinal Injury Association (ASIA) scale was used to assess the initial neurological status and during the follow-up period. Laboratory investigations included blood tests for complete blood count (CBC), CRP, and ESR. Radiological investigations included plain anteroposterior, lateral, and flexion/extension X-rays, computed tomography (CT), and magnetic resonance imaging (MRI) of the index spine segment with and without contrast enhancement. The diagnosis was confirmed by blood culture if positive and tissue biopsy to identify the bacterial pathogen if imperial therapy failed.

Reported comorbidity included the following: four patients had diabetes mellitus (DM) and two hepatitis C virus (HCV); one patient was on dialysis; one patient had a history of drug abuse.

The patients who met the inclusion criteria were divided into two groups according to the method of management. Group I included the patients who only received conservative treatment, including bed rest, spinal orthosis, and antibiotics; Group II included the patients who were managed with posterior surgical decompression with or without fixation plus spinal orthosis and systemic antibiotics. Surgical treatment was considered in patients with acute or progressive neurological deficits, a paravertebral or epidural abscess

>2.5 cm, spinal instability, or failure of empirical conservative therapy. Failure of conservative management was defined as progressive clinical and laboratory deterioration despite adequate antimicrobial treatment. Spinal fixation was indicated in cases with radiological instability. Spinal instability was defined as segmental kyphosis >15°, vertebral body collapse > 50%, or translation >5 mm.[21]

Conservative or medical empirical management included four weeks of intravenous antibiotics, followed by eight weeks of oral antibiotics, eight weeks of complete bed rest, and ten weeks of spinal orthosis. The aim of bed rest was to decrease pain, stabilize the spine, and prevent deformity. Empirical antibiotic treatment was started when the microorganism was not identified by blood culture or tissue biopsy. The empirical antibiotics prescribed were intravenous vancomycin 1 gm twice daily, ceftriaxone 2 gm once daily, and metronidazole 500 mg three times daily for ten days given combined to cover the Gram-positive, Gram-negative, and anaerobic bacteria. Appropriate antibiotics were administered based on the results of microbial culture or biopsy and the advice from the staff of the infection control and prevention department. For tuberculosis infection, a combination of rifampicin 10 mg/kg and isoniazid 5 mg/kg for 12 months with ethambutol 15 mg/kg and pyrazinamide 25 mg/kg for the first two months was prescribed. For brucellosis, a combination of doxycycline and rifampin was given for two months. The withdrawal of antibiotic treatment was indicated based on clinical improvement, including back pain and ability to bear weight, laboratory results, including reduction of ESR and CRP, and advice from the infection control and prevention physician.

Surgical Procedure

During the surgical technique, patients were placed in a prone position where laminectomy was performed for decompression of the nerve roots and thecal sac. Care was taken during laminectomy to preserve the facet joints as much as possible to maintain spinal stability. Infected disc material with subsequent necrotic endplate debridement using disc curettes was performed through a limited microscopic surgical approach if fusion was not indicated. Samples for organism cultures were taken from purulent or inflamed tissue materials. Posterior transpedicular screw fixation and either posterolateral or interbody spinal fusion were performed if stability was compromised by either the surgical technique or the infection process. The patient's own healthy bone harvested during decompression was used in the fusion; otherwise, iliac bone graft was used. In some patients, additional spinous processes of the adjacent vertebrae were harvested to enhance fusion.

Postoperative Care:

Wound drains were left for 3–5 days postoperatively for antibiotic lavages, according to the culture and sensitivity findings. The patients received postsurgery intravenous antibiotic therapy for 6 to 8 weeks to ensure radical eradication of infection, especially in debilitated patients.

During the follow-up visits at the outpatient clinic, the patients were assessed clinically and by laboratory investigations. The follow-up assessment was scheduled at 1, 3, 6, and 12 months following the start of either medical or surgical treatment. Moreover, the clinical outcomes were assessed using VAS of BP, ASIA score, and Kirkaldy-Willis functional outcome criteria. CBC, CRP, and ESR were evaluated and recorded on follow-up visits. Spinal fusion of the affected segment with proper implant purchase was considered as cure criteria on follow-up radiological imaging. Spinal fusion was assessed with plain spinal radiographs in all patients and CT scan in 8 patients and was reported if there was a lack of motion on lateral flexion and extension views and bridging trabecular bone across the interspace. New imaging in the form of MRI LSS with contrast was done if there was a clinical deterioration or an evidenced alteration in the laboratory findings.

Statistical Analysis:

Data were statistically described in terms of mean ± standard deviation (± SD), median and

range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was made using the Mann–Whitney *U* test for independent samples. Within-group comparison of numerical variables was made using Wilcoxon's signed-rank test for paired (matched) samples. For comparing categorical data, Chi-square (χ^2) test was performed. Fisher's exact test was used instead when the expected frequency is less than 5. Two-sided *P* values less than 0.05 were considered statistically significant. All statistical calculations were done using the computer program IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Windows.

RESULTS

This study included 27 patients who presented with primary spondylodiscitis during the four-year period of the study. There were 17 males and 10 females. The mean age was 49.96 ± 9.83 (range, 31–71) years. All patients presented with BP over the involved vertebral level, while nine patients (33.3%) had neurological deficits, including six patients with ASIA Grade D and three ASIA Grade C. The mean time from onset of symptoms to diagnosis was 3.56 ± 1.58 months.

Group I (medical group) included eight patients (29.6%), while Group II (the surgical group) included 19 patients (70.4%) (Figures 1 and 2). In the medical group, two patients (25%) had the thoracic spine affected (T7-T8 in one patient and T8-T9 in the other patient), and six patients (75%) had the lumbar spine involved (L4-L5 in three patients; L5/S1 in one patient; L4-L5 and L5-S1 in one patient; L3-L4 and L5-S1 in one patient).

In the surgical group, six patients (31.6%) had the thoracic spine affected (T7/T8 in two patients, T9/T10 in one patient, T11-T12 in one patient, T9-T11 in one patient, and T10-T12 in one patient) and thirteen patients (68.4%) had the lumbosacral spine (LSS) involved (L4-L5 in five patients, L5-S1 in three patients, L3-L5 in two patients, L3-L4 and L5-S1 in two patients, and L4-S1 in one patient). Seven patients underwent limited laminectomy and debridement, while 12 patients (63.2%) underwent decompression, debridement, fixation, and spinal fusion. The mean follow-up was 16.48 ± 0.6 (range, 13–24) months. The main perioperative characteristics of the patients in the study groups are shown in Table 1.

Despite the marked improvement of VAS score at 1, 3, 6, and 12 months of the follow-up period in both the medical and surgical groups, it was only statistically significant with the surgical group. VAS score was reduced significantly in the surgical group in comparison with the medical group at 1 and 3 months (*P* value < 0.001 and = 0.010, respectively) but not at 6 and 12 months of the follow-up period (*P* value = 0.235 and 0.886, respectively) (Figure 3).

Preoperatively, the CRP level was elevated in all the patients and showed marked improvement in all patients during the follow-up. The decrease in CRP was statistically significant within both groups at 1-, 3-, 6-, and 12-months following surgery without statistically significant difference between both groups. Similarly, the first hour ESR was elevated preoperatively and showed marked improvement in all patients during the follow-up. The decrease in ESR was statistically significant in both groups at 1-, 3-, 6-, and 12-months following surgery without statistically significant difference between both groups.

At three-month follow-up, 17 of 19 patients in the surgical group had good outcomes according to the Kirkaldy-Willis functional outcome criteria compared to only four of 8 patients in the medical group. There was no significant difference in the functional outcome between the two groups at the same time point (*P* value = 0.118). On the other hand, at 12-month follow-up, 13 of 19 patients in the surgical group and four of 8 patients in the medical group showed excellent outcomes, still with no statistically significant difference at this time point (*P* value = 0.472) (Figure 4).

Reported complications in the medical group included the following: one patient developed DVT; one patient deteriorated neurologically to ASIA Grade D two weeks after the start of medical treatment where laminectomy was offered, with no organism detected, and his motor power was recovered postoperatively; and one patient died on postadmission day 14 due to septicemia and multiple organ failure. In the surgical group, three patients developed postoperative anemia due to toxemia and operative blood loss necessitating blood transfusion; one patient developed DVT; one patient (ASIA Grade E) underwent laminectomy without fixation due to tuberculous affection of L3-L4 and L5-S1 and received a second operation eight weeks after surgery with fusion because of uncontrollable pain which improved following the fusion; one patient developed wound dehiscence and was managed by wound debridement and resuturing; and one patient died on day 17 postoperatively due to massive pulmonary embolism. No statistically significant difference was observed in the complication rates between the two groups (*P* value = 0.509).

Table 1. The characteristics of the patients in the study groups.

Characteristic	Medical group (N = 8)	Surgical group (N = 19)	*P* value
Age/years	52.25 ± 12.17	49.00 ± 8.86	0.613
Male/female	5/3	12/7	1.000
Clinical presentation			
Fever	5 (62.5%)	11 (57.9%)	1.000
Neurological deficit (ASIA)	0 (0%)	9 (47.4%)	0.026*
Symptom duration/months	3.5 ± 2.2	3.58 ± 1.31	0.766
Spinal levels involved			
Thoracic spine	2 (25%)	6 (31.6%)	1.000
Lumbosacral spine	6 (75%)	13 (68.4%)	
Causative organism			
Mycobacterium tuberculosis	-	9 (47.4%)	0.055
Brucellosis	3 (37.5%)	2 (10.5%)	
Staphylococcus aureus	-	2 (10.5%)	
Streptococcus	-	1 (5.3%)	
No organism detected	5 (62.5%)	5 (26.3%)	
Preoperative laboratory parameters			
WBC (10^3/mm^3)	9.31 ± 4.52	9.73 ± 5.64	0.873
CRP	35.25 ± 28.69	38.47 ± 19.12	0.366
ESR	64.25 ± 28.09	67.05 ± 36.21	0.894
Hospital stay/days	22.00 ± 13.83	19.16 ± 8.73	0.690
Follow-up period/months	17.29 ± 3.82	16.17 ± 2.62	0.542

* *P* value less than 0.05 was considered statistically significant.

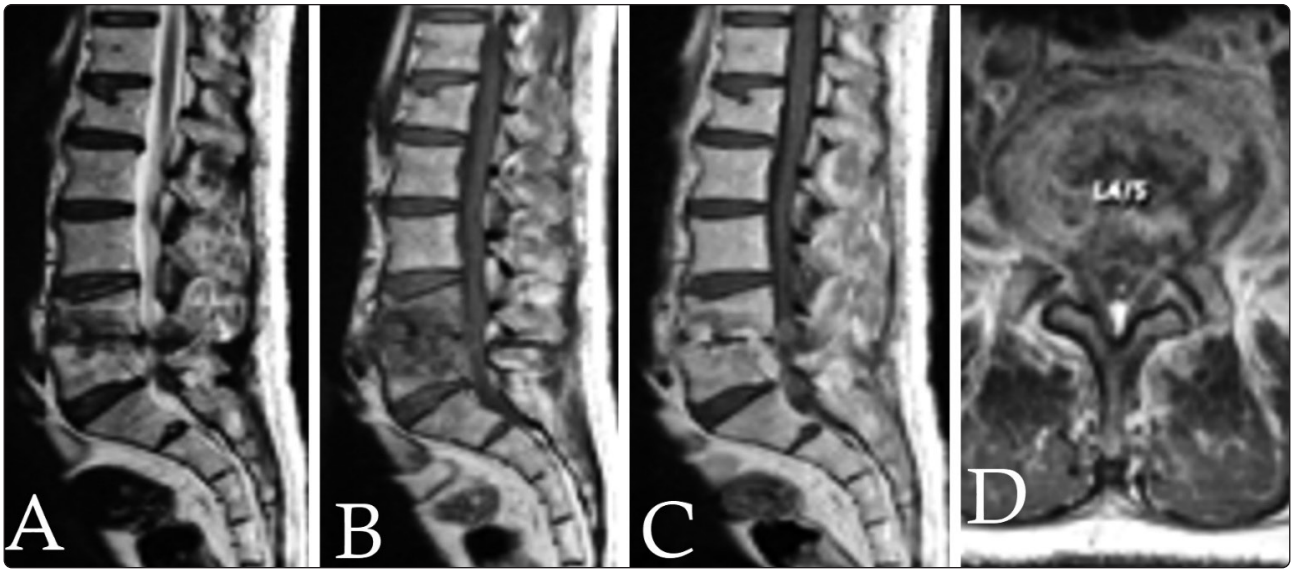

Figure 1. A 71-year-old male who presented with low back pain and fever with no neurological deficits. Sagittal MRI studies of the lumbosacral spine (LSS) without contrast. (A) T2-weighted sequence and (B) T1-weighted sequence show spondylodiscitis centered at L4-L5 disc level manifested by the reduced height of the disc displaying intradiscal areas of bright T2 signal intensity and marrow edema pattern of the adjoining vertebral endplates displaying low T1 and high T2 signal intensity with mild anterior wedging of L4 vertebral body. (C) Sagittal T1-weighted sequence and (D) axial T1-weighted sequence MRI LSS with contrast show intense contrast enhancement of L4-L5 disc, inhomogeneous contrast enhancement of the adjoining vertebral endplates, and associated enhancing intraspinal and pre- and paravertebral soft tissue sheets, entrapping the L5 nerve roots at their lateral recesses. The patient was proven to have brucellosis and he was managed medically with excellent outcome at the final follow-up period.

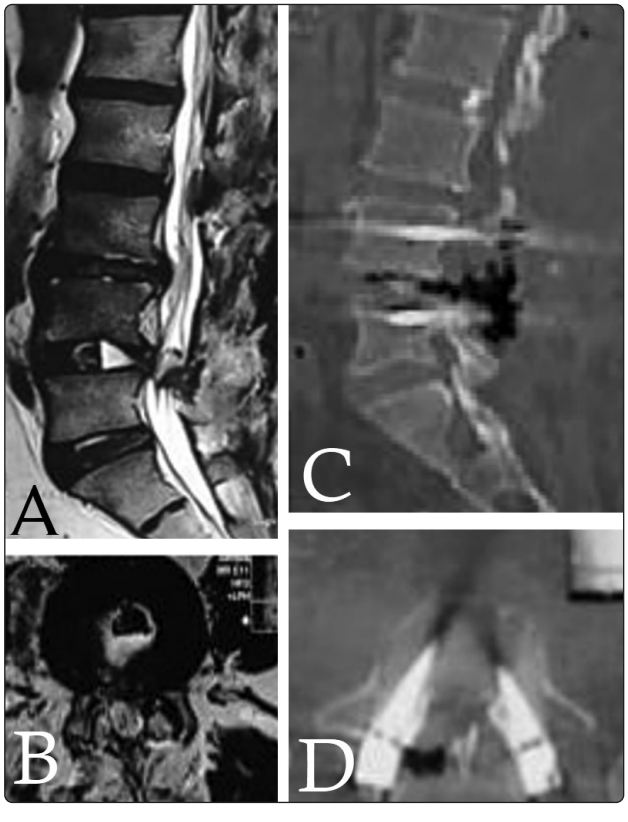

Figure 2. A 50-year-old man who presented with low back pain and fever with failure of medical treatment. MRI LSS (A) sagittal and (B) axial T2-weighted sequence show altered signal intensity of L4-L5 disc substance displaying bright signal intensity with epidural soft tissue signal. CT LSS (C) sagittal and (D) axial cuts show evidence of spinal laminectomy of L3 and L4 vertebrae and internal fixation of L4 and L5 vertebrae. Biopsy was positive for *Mycobacterium tuberculosis*. He had an excellent outcome at the final follow-up period.

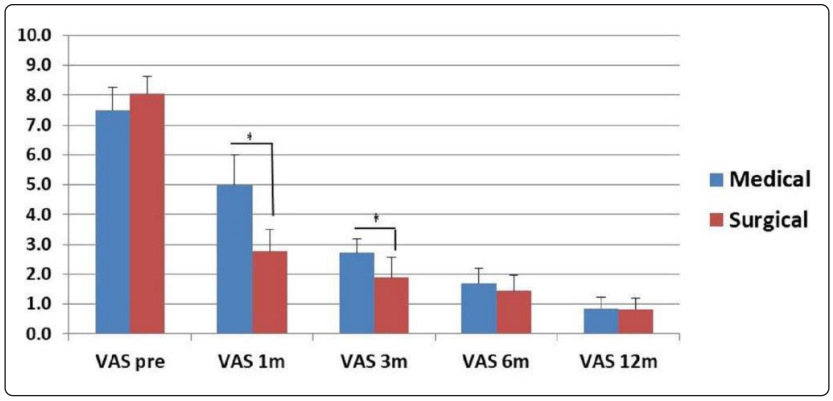

Figure 3. Mean VAS score over time between the two study groups.
* *P* value less than 0.05 was considered statistically significant.

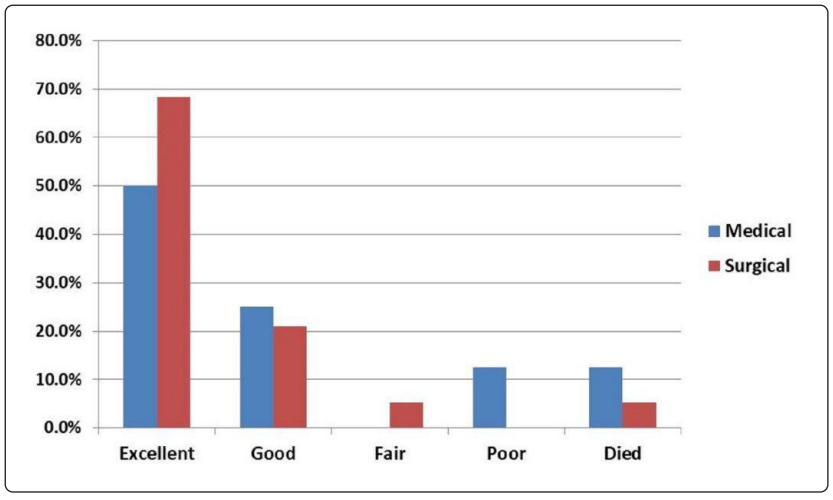

Figure 4. Distribution of outcomes at 12 months between the two study groups according to the Kirkaldy-Willis functional outcome criteria.

DISCUSSION

Spontaneous or primary spondylodiscitis is a major medical illness that constitutes a great health, social, and economic burden. Adequate and early management has a great impact on clinical outcomes. Conservative and medical therapy is the mainstay measure in most patients. In the current study, we report 27 patients with spontaneous spondylodiscitis who were managed either medically or surgically in our hospital.

We used VAS to report the pain outcome in the surgical and medical cohorts separately during the follow-up period. VAS improved over time in both groups, being statistically significant in the surgical group. Improvement of VAS scores over time points demonstrates that an adequate treatment algorithm ensures effective pain relief and good quality of life. However, surgically treated patients showed much faster improvements in VAS at 1 and 3 months of the follow-up period. Two previous studies[20,26] reported VAS at follow-up in medical and surgical patients, revealing that the surgical patients experienced a significantly lower VAS score than medical patients. These studies suggested a more rapid recovery following surgical intervention coupled with antibiotics compared with the medical treatment alone, but with diminishing significance over time. Surgery may have a role in enhancing patients' short-term recovery but may unlikely change the long-

term results as most patients will have substantial improvement in back pain regardless of treatment modality. Another two articles[1,10] have reported pain outcomes of the surgical and medical cohorts separately at the last follow-up, with 85% (50/59) of surgical patients experiencing pain-free outcome compared with 52% (37/72) of medical patients.

Primary spondylodiscitis has generally been considered a medical disease requiring external immobilization or bed rest and prolonged antibiotic therapy as the first-line treatment, which is reasonable in early stages without neurologic deficits and in case of severe comorbidities limiting the surgical options.[8] The optimal duration for antibiotic therapy is debatable. The only randomized controlled trial on this topic established no differences in the outcome after administering 6- and 12-week tailored antibiotic treatment.[3] When the biopsy is inconclusive and there is only a necrotizing granulomatous inflammation, there is a debate about which antibiotic regimen should be followed. Güler et al.[9] suggested that in countries where TB incidence is high, TB should be considered the first differential diagnosis. However, failure rates following conservative treatment due to persistent pain, noneradicated infection, or spinal malunion range from 12% to 18%.[7]

We used the posterior approach, namely, posterior decompression with or without fusion, for treating our patients with primary spondylodiscitis when surgery was indicated. The main goals of surgical treatment of spondylodiscitis are early decompression of the spinal cord in the presence of neurological deficits, infected tissue debridement, and stabilization of the involved vertebral segment. Posterior stabilization with anterior decompression and interbody fusion had been considered the preferred surgical treatment for spondylodiscitis.[12] Although the anterior approach provides better removal of the infected disc under direct vision, maximizes bacterial identification, and decreases sepsis, anterior fixation alone does not provide great stability in the involved spinal levels and posterior fixation is mandatory.[18] Včelák et al.[28] compared the two methods and they concluded that the dorsal approach had minimum serious surgical complications and greater loss of sagittal balance without clinical correlation. They did not find any relapse of the infection following the two-stage posteroanterior surgery.

Few studies have discussed treating spondylodiscitis with the posterior approach only. Lee et al.[13] demonstrated that stabilizing the spine with pedicle screws and titanium mesh prevented the deformity in patients with tuberculous spondylitis and the metallic implants did not prohibit infection control. Lin et al.[14] reported that long posterior instrumentation with short posterior or posterolateral fusion in the treatment of pyogenic spondylodiscitis was effective in terms of infection control, correction of kyphosis, and restoration of neurological impairment. Most of their patients achieved a good functional outcome after surgery. Mohamed et al.[19] showed that long posterior pedicle screws fixation combined with aggressive antibiotic therapy resulted in resolution of spinal infection in 15 patients. Titanium alloy is less prone to colonization than stainless steel, with fewer rates of relapse of the infection.[11] Minimally invasive surgery for disc debridement and/or combined approaches for instrumentation lead to good outcomes in patients with single-level lumbar pyogenic spondylodiscitis and could be an alternative to conventional open surgery.[15,27] Percutaneous pedicle screw instrumentation with or without minimally invasive decompression and debridement or with a second anterolateral debridement/corpectomy is increasingly used.[24]

In this study, CRP and ESR were significantly decreased through all follow-up points without any difference between both groups. Surgery did not offer any advantage in reducing CRP and ESR over the medical treatment because infection clearance is strongly dependent on proper antibiotic therapy. These results are in line with the findings of Nasto et al.,[20] who found that CRP and ESR levels decreased in both groups accordingly: one group was treated with posterior

percutaneous spinal instrumentation for single-level pyogenic spondylodiscitis and the other group treated with thoracolumbosacral orthosis (TLSO) rigid bracing, with a positive response to therapy with no significant differences.

In our study, the functional outcome was better in the surgical group; however, it was of no statistical significance. Similarly, no significant difference was observed in the rate of complications between the two groups. In the literature, reports of the functional outcomes of spondylodiscitis in both medical and surgical groups are lacking. In a recent systematic literature review and meta-analysis,[25] functional outcomes were reported in only 20 studies (13 surgical). Return to work status was reported in only four studies.[4,16,17,22] Shetty et al.[22] found acceptable clearance of infection and satisfactory deformity correction and functional outcome with a low incidence of cage migration, loosening, or infection recurrence in a retrospective analysis of 27 consecutive patients with lumbar pyogenic spondylodiscitis treated with posterior instrumentation and transforaminal lumbar interbody fusion. They reported excellent outcome in 51.9%, good outcome in 33.3%, fair outcome in 11.1%, and poor outcome in 3.7% of their patients. However, Lu et al.,[16] in a review of 28 patients who underwent transforaminal lumbar interbody debridement and fusion, reported one postoperative deep wound infection with septic implant loosening and one instance of early aseptic implant loosening leading to implant removal. They also found two recurrences of infection within three months postoperatively. Among the included surgical series, 88% of patients were able to return to normal work activity. Surgical patients experienced excellent outcomes in 68% of those reported at follow-up, which is comparable to all patients where an excellent outcome was achieved in 73% of patients.[25]

This study is limited by its retrospective nature, is not a comparative one, and suffers from selection bias as the patients who were treated surgically tended to be those who suffered intractable back pain, neurological deficits, or progressive spinal deformity. Thus, the outcome comparison between medical and surgical treatment groups with a nonuniform preoperative diagnosis with different phases of spondylodiscitis may be inherently biased. Moreover, local kyphosis at the end of the follow-up period in both groups should be evaluated radiologically. The statistical evaluation was also limited by the small number of patients due to the lower disease incidence. Further prospective randomized comparative studies with more patients comparing the surgical and medical patients with similar clinical features are required to provide further insight into the clinical outcomes. The use of more scores to identify patients' complaints and their improvement such as the Oswestry disability index (ODI) is also recommended.

CONCLUSION

Posterior decompression with or without fusion was more effective than medical treatment in reducing the pain in patients with primary spondylodiscitis at 1 and 3 months of the follow-up period without influencing the final clinical outcome. Conservative treatment still had a role in the management of primary spondylodiscitis.

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الملخص العربي

النتائج السريرية بعد علاج التهاب الفقرات الأولي: سلسلة من سبعة وعشرين مريضًا

البيانات الخلفية: هناك جدل حول ما إذا كان يجب استخدام العلاج بالمضادات الحيوية بمفرده أو مع الجراحة لعلاج التهاب الفقرات الأولي.

تصميم الدراسة: دراسة حالات استعادية إكلينيكيا.

الغرض: تقييم النتائج السريرية بعد علاج المرضى الذين يعانون من التهاب الفقرات الأولي والإبلاغ عن نتائج الألم في هؤلاء المرضى .

المرضى و الطرق: أجريت هذه الدراسة على 27 مريضا يعانون من التهاب الفقرات الأولي. كان يوجد 17 ذكر وعشر إناث. كان متوسط العمر 49.96 ± 9.83 (المدى ، 31-71) سنة. عانى جميع المرضى من آلام موضعية في مستوى العمود الفقري الملتهب. تم تقييم النتائج السريرية باستخدام المقياس التناظري البصري للألم ومعيار كيركالدي-ويليس للنتائج الوظيفية.

النتائج: ثمانية مرضى (29.6٪) تمت معالجتهم عن طريق العلاج الدوائي وحده. تسعة عشر مريضا (70.4٪) تمت معالجتهم جراحيا بما في ذلك سبعة مرضى خضعوا لعملية استئصال الصفيحة الفقرية. بينما خضع 12 مريضًا للجراحة عن طريق تخفيف الضغط الخلفي وتثبيت الفقرات متبوعًا بعلاج لاحق بالمضادات الحيوية لالتهاب الفقرات الأولي .تم تخفيض درجة المقياس التناظري البصري للألم بشكل ملحوظ في المرضى الذين عولجوا جراحيًا مقارنة بالمرضى الذين عولجوا دوائي بعد شهر و ثلاثة أشهر من تلقي العلاج (قيمة P <0.001 و = 0.010 على التوالي) ، ولكن ليس بعد ستة و اثني عشر شهرًا من فترة المتابعة (قيمة= P 0.235 و 0.886 على التوالي). لم يكن هناك فرق إحصائي بين المجموعتين فيما يتعلق بمعدلات خفض البروتين التفاعلي سي أو معدل ترسيب كرات الدم الحمراء، أو النتائج الوظيفية، أو المضاعفات في فترات زمنية مختلفة.

الخلاصة: كان تخفيف الضغط الخلفي مع أو بدون تثبيت الفقرات أكثر فعالية من العلاج الدوائي لتقليل الألم في المرضى الذين يعانون من التهاب الفقرات الأولي عند شهر وثلاثة أشهر من فترة المتابعة دون التأثير على النتائج السريرية النهائية.