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ORIGINAL ARTICLE

Challenging cervical spondylodiscitis: Is interventional treatment superior to conservative management?

Çiğdem Yalçın[1]
ORCID: 0000-0002-4857-1975

Ali Kutta Çelik[2]
ORCID: 0000-0002-0660-7482

Oğuz Kağan Demirtaş[3]
ORCID: 0000-0002-3913-5899

[1]Department of Algology, Mersin City Training and Research Hospital, Mersin, Türkiye

[2]Department of Infectious Diseases, Mersin City Training and Research Hospital, Mersin, Türkiye

[3]Department of Neurosurgery, Ankara Etlik City Hospital, Ankara, Türkiye

Corresponding Author: Çiğdem Yalçın
E-mail: mdcigdem@gmail.com

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ABSTRACT

Objective: Cervical spondylodiscitis is a rare spinal infection with limited literature on its management. While antibiotic therapy is critical for infection control, addressing residual pain and functional deficits remains challenging. This retrospective observational study evaluated the efficacy and safety of interventional management in patients with spontaneous cervical spondylodiscitis.

Materials and Methods: Patients were treated with either medical therapy or interventional pain management after completing antibiotic therapy and physical rehabilitation. The outcomes of interventional pain management (Group 1, n=9) and medical therapy (Group 2, n= 12) in improving pain, functional capacity, and quality of life in patients with cervical spondylodiscitis were compared. Treatment responses were assessed using Numerical Rating Scale (NRS), Neck Disability Index (NDI), and SF-12 scores before and after therapy. Changes in cervical lordosis angles were also monitored.

Results: Of the 35 screened patients, 21 met the inclusion criteria, with 12 opting for medical therapy and 9 for interventional treatment. Both groups demonstrated significant improvements in NRS, NDI, and SF-12 scores after treatment ($p<0.05$). Interventional therapy resulted in superior NRS and NDI outcomes compared to medical therapy (NRS: 1.11 vs. 2.33, $p=0.017$; NDI improvement: 76% vs. 56.66%, $p=0.0009$). No significant changes in cervical lordosis angles were observed in either group.

Conclusion: Interventional pain management provides superior pain relief and functional improvement compared to medical therapy alone in patients with cervical spondylodiscitis. Conservative management is effective in appropriately selected cases, offering an alternative to surgery for those without instability or neurological deficits.

Key words: cervical osteomyelitis, interventional pain treatment, cervical spondylodiscitis, spine, pain, infections, injections

INTRODUCTION

Spondylodiscitis is a serious medical condition characterized by infection of the discs in the spine [1,2]. The disease is caused by the invasion of bacteria or fungal agents and can lead to symptoms such as severe pain, fever, instability and neurological deficits. Spondylodiscitis is a highly catastrophic disease and can significantly increase the risk of morbidity and mortality [3,4]. The cervical spine is a rare location for spondylodiscitis due to its relatively better blood and lymphatic supply than other regions of the spine [5].

In the treatment of spondylodiscitis, the primary goal is infection control [6,7]. Therefore, long-term antibiotherapy appropriate to the agent forms the cornerstone of treatment. Afterwards, the aim is to restore pain and functional capacity. This may require medical treatment, physical therapy and interventional pain treatments. Surgery should be preferred only in cases with progressive neurologic deficits and/or severe instability [8].

Since cervical spondylodiscitis is an extremely rare condition, there is a gap in the literature regarding its management. In this study, we aimed to evaluate the efficacy and safety of conservative treatment without indication for surgery by comparing the outcomes of only medical therapy or interventional pain management in patients with spontaneous cervical spondylodiscitis. Our hypothesis suggests that interventional pain management such as trigger point injection, facet joint injection may be an effective method to significantly reduce pain and improve quality of life in patients with cervical spondylodiscitis when medical therapy alone is inadequate.

A preliminary version of this work has been previously made available as a preprint on Research Square (link was anonymized)

MATERIALS AND METHODS

The study was conducted according to EQUATOR STROBE observational study guidelines. After obtaining approval from the Toros University Clinical Research Ethics Committee of local board (123/27.10.23), the files of patients diagnosed with vertebral osteomyelitis between December 2017, and January 2023, were retrospectively screened. The center of this study is a tertiary-care state hospital serving approximately 1.8 million people. There is only one other tertiary-care university hospital in the region.

After excluding thoracic and lumbar spondylodiscitis cases, cervical osteomyelitis cases were included in the study. All the patients were older than 18 years, and none had a history of malignancy. Patients with severe deformities, progressive neurological deficits and/or instability were also excluded due to necessity of surgical treatment. Patients who did not follow up regularly and who had missing/incomplete data were excluded.

Diagnosis: Diagnosis and treatment plans for patients were determined by a multidisciplinary team consisting of infectious disease specialists, radiologists, physical therapists, pain specialists, and neurosurgeons. Following a comprehensive clinical history and physical examination, all patients underwent a series of tests, including complete blood count (CBC), C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), QuantiFERON TB test, Brucella-specific agglutination tests, standing cervical X-rays, and contrast-enhanced MRI. Post-treatment response was monitored based on clinical improvement, CRP decline and long-term MRI contrast reduction. Additionally, deformity progression was tracked by monitoring the cervical lordosis angle on standing cervical X-rays.

Participants: Medical files of patients diagnosed with spondylodiscitis were evaluated. Patients with involvement of the lumbar and thoracic spine, progressive neurological deficit and severe instability and underwent surgical intervention and patients with missing data during follow-up were excluded. After antibiotic therapy and physiotherapy, patients preferred medical treatment, or interventional treatment for pain (Figure 1).

Infection treatment: Monthly follow-up of the patients was carried out by infectious disease physician until inflammation was resolved according to a control MRI. Teicoplanin + ciprofloxacin was given for three months in the presence of pyogenic involvement. In brucellosis,

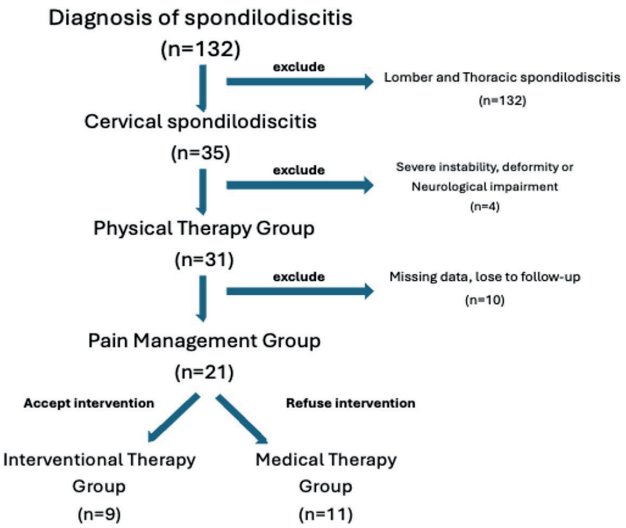

Figure 1. Flow diagram of study ınclusion and exclusion criteria

streptomycin + rifampicin + doxycycline was given for three weeks; then, streptomycin was stopped and the rifampicin + doxycycline treatment was applied for seven months (total treatment time was eight months). In pyogenic cases, if no clinical or radiological response is obtained at the end of the 2-month treatment and the QuantiFERON test is positive, the treatment is switched to isoniazid + rifampicin + ethambutol + pyrazinamide and this regime continued for a minimum of 6 months. The cervical MRI images of all the patients were interpreted by the same radiologist and CRP response was monitored for infectious disease specialist.

Pain and functional treatment: After cure was achieved following antibiotherapy, all patients were first referred to the physiotherapy (PT). After physical therapy, patients with persistent pain were informed about medical pain treatment and interventional pain treatments. Patients were divided into two groups as interventional (group 1) and medical (group 2) according to their preferences.

Interventional Therapy (Group 1): Trigger point injection if there was a tender point in the sternocleidomastoid (SCM) muscle or trapezius, a facet medial branch block if cervical facet tenderness was detected, and a cervical epidural injection was administered if there was accompanying cervical disc herniation. Trigger point injections are performed into the sternocleidomastoid (SCM) muscle and trapezius muscle. Painful tender points are identified through palpation, and 0.1-0.2 ml of lidocaine is injected using an insulin syringe. Additionally, bilateral medial branch blocks of the facet joints are performed at levels including those above and below the affected level due to spondylodiscitis. The procedure is guided by fluoroscopy, and for each facet joint, a combination of 0.5 ml of bupivacaine and dexamethasone is injected (Figure 2). Interlaminar cervical epidural injection was applied through the C7-T1 space, and 8 mg of dexamethasone was administered.

Medical Therapy (Group 2): For patients unwilling to undergo interventional treatment, duloxetine hydrochloride is initiated at a dose of 30 mg/day and increased to 60 mg/day after one month (Figure 1).

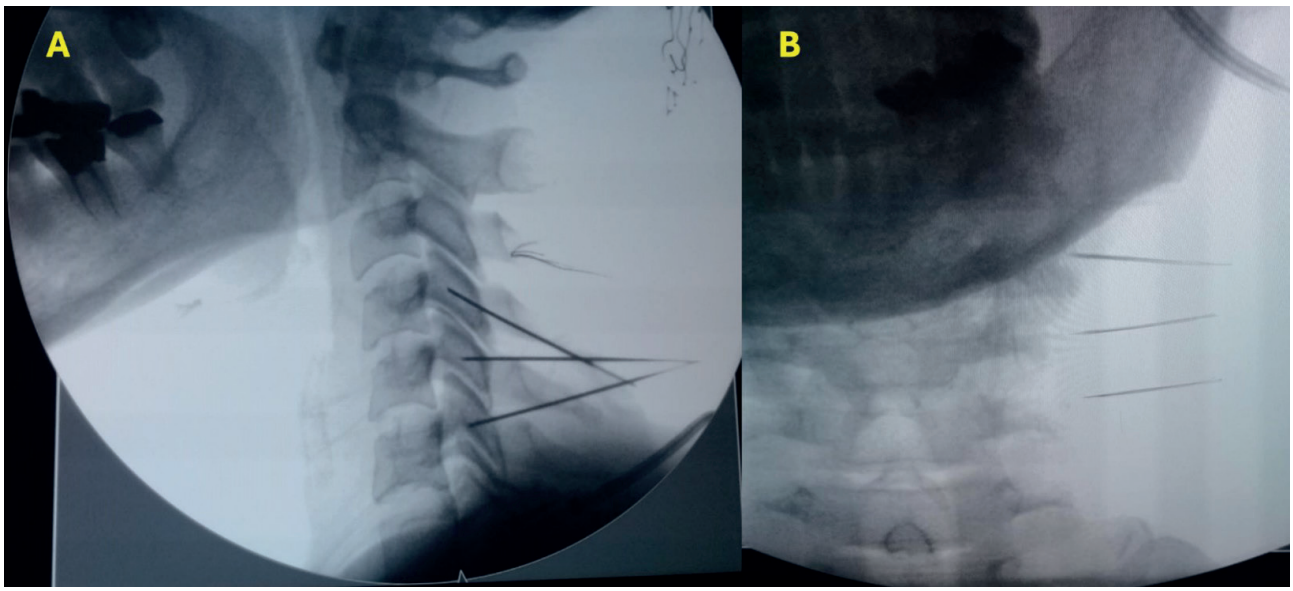

Figure 2. Lateral (A) and antero-posterior (B) Fluoroscopic images of medial branch block of the facet joint

Follow-up: Numerical Rating Scale (NRS) of the patients were recorded before treatment (NRS-0), after antibiotic treatment (NRS-1), after PT (NRS-2), and at six months after medical or interventional treatment (NRS-3). Neck Disability Index (NDI) and SF-12 scores were recorded before and six months after the procedure (Table 1).

Deformity Monitoring: Patients were monitored for the development of kyphosis secondary to spondylodiscitis using standing lateral cervical X-rays. The lordosis angles were measured from the radiographs taken at the time of diagnosis and one year after treatment. The groups were compared in terms of changes in lordosis.

Statistical analysis

IBM SPSS Statistics v. 22 (IBM SPSS, Armonk, New York, United States) software package was used for the statistical analyses of the data obtained from the research. The Shapiro-Wilk test was conducted to check whether the parameters were normally distributed. Descriptive statistical methods (mean, standard deviation, median and interquartile range, and frequency) were used to present the data. Independent quantitative parameters were compared between the groups using the Mann-Whitney U test. Dependent quantitative parameters were compared between the groups using the Wilcoxon test. The comparison of two independent variables that conformed to a normal distribution was made with Student t-test. $P < 0.05$ indicated statistical significance in all the analyses.

RESULTS

A total of 132 patients were diagnosed with spondylodiscitis during the specified period. Of these, 97 were excluded due to involvement of the lumbar and thoracic spine. Four patients were considered unsuitable for study inclusion due to progressive neurological deficit and severe instability and underwent surgical intervention. Ten patients were excluded due to missing data during follow-up. The remaining 21 patients were included in the study. After antibiotic therapy and physiotherapy, 12 patients preferred medical treatment, while 9 patients chose interventional treatment.

Descriptive Data: The average age of the patients was 58.33±10.65 (40-79) years. The average age was 56.22±7.88 (45-69) years in the interventional therapy group and 59.91±12.43 (40-79) years in the medical treatment group (p=0.22). There were 12 (57.14%) female patients and 9 (42.85%) male patients. The mean follow-up period was 28.80±10.15 (14-54) months. Seven patients (33.33%) had involvement at the C6-7 level, six patients (28.57%) had involvement at the C5-6 level, five patients (23.8%) had involvement at the C4-5 level, and three patients (14.28%) had involvement at the C3-4 level. Two patients (9.52%) had clinical and laboratory signs of Brucellosis and took an eight-month antibiotic therapy regimen. The remaining nineteen patients (90.47%) responded well to the wide-spectrum pyogenic antibiotic therapy. None of the patients has received an anti-tuberculosis regimen in this series. None of the patients has a previous surgical history.

Outcome Data: Pre-treatment pain score (NRS1) was 8.90±0.76 (8-10), while post-antibiotic therapy pain score (NRS2) was 5.33±1.46 (3-9), post-physical therapy pain score (NRS3) was 5±1.30 (3-7), and final pain score (NRS4) measured 6 months after medical or interventional pain treatment was 1.80±1.07 (0-4). Pairwise comparisons between groups revealed that NRS1 was significantly higher than NRS2 ($p<0.0001$), there was no significant difference between NRS2 and NRS3 (p=0.5157), and NRS3 was significantly higher than NRS4 ($p<0.0001$) (Table 1).

The mean SF-12 questionnaire score of the patients before treatment was 31.23±2.84 (27-37), while the SF-12 score after medical or interventional pain treatment was 36.61±2.99 (31-42), indicating a significant improvement ($p<0.0001$) (Table 2).

Table 1. Comparison of pain scores between groups with Mann Whitney U test

	Interventional	Medical	P
NRS-1 (Before Treatment)	8.66±0.86	9.08±0.66	0.242
NRS-2 (After Antibiotherapy)	5.44±1.13	5.25±1.71	0.522
NRS-3 (After Physiotherapy)	4.88±1.05	5.08±1.50	0.833

Mean ± Standard Deviation

Table 2. Comparison of SF-12 scores between groups with Mann Whitney U test and change after treatment with Wilcoxon test

	Interventional	Medical	P (Significance between groups)
SF12 Before Treatment	31.44±3.71	31.08±2.15	0.94
SF12 After Treatment	39.77±1.98	37.75±3.38	0.16
SF12 Change	8.33±2.64	6.66±3.44	0.35
P (Significance within time)	**0.0089 ***	**0.0033 ***	

* p< 0.05, Mean ± Standard Deviation

Table 3. Comparison of neck disability index (NDI) percentage between groups with Mann Whitney U test and change after treatment with Wilcoxon test

	Interventional	Medical	P (Significance between groups)
NDI Before Treatment	83.77±8.8	82.5±11.57	0.770
NDI After Treatment	7.77±11.24	25.83±12.77	**0.0049 ***
NDI Change	76±9.21	56.66±11.19	**0.0009 ***
P (Significance within time)	**0.0089 ***	**0.0024 ***	

* p< 0.05, Mean ± Standard Deviation

Table 4. Comparison of cervical lordosis between groups with Mann Whitney U test

	Interventional	Medical	P (Significance between groups)
Cervical Lordosis at Diagnosis	14.97 ± 16.59	10.14 ± 8.39	0.270
Cervical Lordosis after Treatment (one-year)	13.62 ± 8.68	18.58 ± 15.34	0.370

Mean ± Standard Deviation

The pre-treatment Neck Disability Index (NDI) percentage was 41.52±5.12% (33-50), while the post-treatment NDI percentage was 18.09±14.97% (0-52), indicating a significant improvement (p<0.0001) (Table 3).

At the time of diagnosis, the cervical lordosis angles of the patients were found to be 12.21 ± 12.44 (-10.8 - 35.3), while the lordosis angle one year after treatment was determined to be 15.75 ± 11.91 (-8.4 - 38.5). No significant difference was found in the lordosis angles (p=0.26) (Table 4).

Main Results: Medical and interventional pain treatment groups showed no significant differences in NRS1, NRS2, and NRS3 scores obtained before treatment, after antibiotic therapy, and after physical therapy (p values were 0.242, 0.522, and 0.833, respectively). The NRS4 score obtained after the application of different treatments between the two groups was found to be superior in the interventional group (1.11±0.92 (0-2)) compared to the medical treatment group (2.33±0.88 (1-4)) (p=0.017).

Both the medical and interventional pain treatment groups showed significant improvements in SF-12 questionnaire scores before and after treatment (p=0.0089, p=0.0033). However, the magnitude of improvement was not significantly different between the two groups (p=0.35).

Both groups also showed significant improvements in Neck Disability Index (NDI) percentages (p values 0.0089 and 0.0024, respectively). The interventional group demonstrated a greater improvement in NDI (76±9.21% (64-92)) compared to the medical group (56.66±11.19%) (p=0.0009).

No significant difference was observed between the cervical lordosis angles measured at the time of diagnosis and after treatment in both groups.

DISCUSSION

While antibiotic therapy remains the cornerstone of treatment for spondylodiscitis, patients often do not experience adequate improvement in their quality of life, pain scores, and disability following this treatment. Therefore, once the infection is controlled, these patients require additional pain management strategies to facilitate rehabilitation and a return to normal life [9]. This study investigated the effectiveness of interventional or medical treatments following long-term antibiotic therapy for chronic pain, quality of life and disability. The findings suggest that both treatment approaches

had a positive impact on quality of life, disability, and pain scores.

Specifically, facet joint medial branch block and trigger point injections, which target above and below of affected level, were found to be more effective than medical treatment in reducing pain and disability scores. However, no significant difference was observed between the two treatment modalities in terms of quality of life (SF-12 questionnaire). Interventional treatments focus directly on the source of pain, such as facet joints and trigger points [10,11]. This can provide more localized pain relief compared to systemic medication and limit systemic side effects. In a study conducted on patients presenting to the emergency department due to trigger points, one group received trigger point injections while the other group was given NSAIDs. When comparing VAS scores, it was found that the injections were more effective [12]. Because the local anesthetic administered to the trigger point blocks peripheral nociceptive input [13]. Local anti-inflammatory agents may be more effective than systemic treatment, since the main cause of disability and pain in spondylodiscitis is severe inflammation in the affected area [14]. Inflammatory mediators that cause pain are released from degenerated facet joints. Agents administered directly to the area not only exhibit anti-inflammatory effects but also reduce pain by washing away inflammatory cytokines in the area [15]. A critical predictor of the efficacy of systemic therapies is the reaching of a therapeutic concentration of the drug in the blood. This can delay the onset of pain relief, especially in conditions such as spondylodiscitis associated with acute and severe pain. Local applications can provide faster pain relief than systemic therapies by delivering drugs directly to the source of pain. This may be an important advantage, especially in the treatment of acute pain and in improving patient compliance.

This study indicates that the need for surgery in spondylodiscitis is gradually decreasing, and the importance of conservative management is growing. This trend can be explained by advances in antibiotic therapy, improved rehabilitation programs and a better understanding of surgery-related morbidity and mortality. Surgical treatment may be considered a last option in the treatment of spondylodiscitis. In this series, none of the patients who did not require surgical treatment at the time of diagnosis subsequently developed a need for surgery [16-18]. Specifically, it was observed that none of the patients developed kyphotic deformity in the sagittal balance parameter, and thus, there was no need for surgery related to this condition. In the presence of neurologic deficit, progressive deformity or instability, surgery can be necessary. However, surgical treatment also has significant risks. Implant placement may lead to difficulties in infection control and poor bone quality may be associated to implant failure [19-22]. In our series, only 4 (11.42%) of 35 patients with cervical spondylodiscitis required surgical treatment. This finding supports the decreasing role of surgical treatment and the importance of conservative management. Considering the cost-effectiveness of conservative treatment, the most appropriate treatment plan for patients should be determined. However, although the need for surgery is decreasing overall, it is important to realize that surgical intervention is critically important and lifesaving for a specific group of patients. In carefully selected cases, such as those with severe neurological deficits or progressive instability, surgery can provide significant therapeutic benefits and improve quality of life.

Limitations

Due to the rarity of spondylodiscitis in the cervical region, the number of patients included in the study was relatively small. Small samples may limit the power of statistical analyses and the generalizability of findings. Secondly, the study has a retrospective design poses inherent limitations. Third, the choice of treatment was left to the patients, and although information was provided objectively, the hypothesis that interventional treatment was superior may have led to a bias in the treatment decision. Fourthly microbiological diagnosis was not obtained from all patients. In some cases, treatment was initiated before microbiologic diagnosis based on the adequacy of radiological, clinical, and laboratory findings for diagnosis. The heterogeneity of the patient population and the variability in treatment approaches make it difficult to establish standardized therapeutic guidelines.

The findings obtained in the study need to be supported in future studies with randomized and prospective data. In addition, the effect of advanced local methods such as radiofrequency thermocoagulation and cryo-ablation for facet blockage may be examined. Further studies with broader scope and controlled designs are required.

This study suggests that both medical and interventional pain treatments following antibiotic therapy can be beneficial for improving pain, disability, and quality of life in patients with cervical spondylodiscitis. Interventional pain management, targeting the source of pain with facet joint injections and trigger point injections, might offer a greater advantage in reducing pain and improving disability compared to medical treatment. However, larger, prospective studies are needed to confirm these findings and explore the role of advanced local methods. While surgery is becoming less frequent due to advancements in conservative management, it remains critically important and potentially lifesaving for a select group of patients. Further research is warranted to optimize treatment algorithms that integrate both conservative and surgical approaches for optimal patient outcomes.

Author contribution

Study conception and design: ÇY and AKÇ; data collection: ÇY and AKÇ; analysis and interpretation of results: OKD; draft manuscript preparation: ÇY and OKD. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by the Toros University (Protocol no. 123/27.10.2023).

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Conflict of interest

The authors declare that there is no conflict of interest.

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