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Transpedicular Screw Fixation Versus Conservative Treatment in the Management of Spondylodiscitis

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Abstract

Background: Spondylodiscitis poses significant challenges in spinal pathology management. This research evaluted outcomes between conservative treatment and transpedicular screw fixation in spondylodiscitis patients.

Patients and Methods: This retrospective study included 32 participants with lumbar or thoracolumbar spondylodiscitis, equally divided into conservative treatment (Group A) and transpedicular screw fixation (Group B) groups. The Oswestry Disability Index (ODI) was used to measure functional capability, while the visual analog scale (VAS) was used to assess pain levels. Follow-ups were conducted at 1, 3, and 6 months post-intervention. The primary outcome was recurrence rate, while secondary outcomes included changes in pain and function, complications, and infection-related death.

Results: VAS and ODI scores were significantly lower in Group B at 3 and 6 months (p<0.05). The recurrence rate was significantly lower in Group B (6.25%) compared to Group A (43.75%) (p=0.037). Infection rates were not significantly different between groups. No cases of hematoma or bleeding occurred in either group.

Conclusions: Transpedicular screw fixation demonstrated superior outcomes in pain relief, functional improvement, and reduced recurrence rates compared to conservative management in spondylodiscitis patients. These findings suggest that surgical intervention may offer better long-term efficacy in managing spondylodiscitis.

Key Words: Spondylodiscitis – Transpedicular screw fixation – Conservative treatment – Pain management – Outcomes – Recurrence.

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Introduction

SPONDYLODISCITIS, an inflammatory condition affecting the vertebral bodies and intervertebral disc space, represents the most prevalent spinal infection **[1,2]**. This condition can be classified into three main categories: Pyogenic, granulomatous, and parasitic **[2-4]**. While spondylodiscitis is most common in the elderly and those with impaired immune systems, it can also develop in younger people with immunodeficiency syndrome, accounting for 2-7% of all instances of osteomyelitis **[5,6]**.

Spondylodiscitis typically presents with gradual, worsening back or neck pain, particularly at night, and can progress to include muscle spasms, weight loss, and symptoms of radiculopathy or myelopathy **[7]**.

Serious consequences, including as neurological abnormalities, irreversible decline in quality of life, ongoing pain necessitating long-term analgesics, and even death in otherwise healthy people, can result from chronic infection or inadequate treatment **[8,9]**.

While medical management, primarily consisting of appropriate antimicrobial therapy, is often sufficient for disease resolution **[10]**, some cases may require surgical intervention. This is particularly true when injury to the motor segment results in instability, reduced mobility, or compression of nervous structures **[11,12]**. The decision-making process for optimal treatment strategies frequently considers factors such as age and comorbidities **[13]**. Additionally, certain lesion subtypes, for example, spinal epidural abscesses, surgical debridement and decompression may be the preferred method of treatment **[14]**.

The Egyptian literature lacks comprehensive clinical studies comparing conservative and surgical options for managing spondylodiscitis patients.

This gap in research underscores the need for further investigation into optimal treatment strategies. Therefore, this research evaluated the outcomes of conservative versus surgical management in patients diagnosed with spondylodiscitis.

Patients and Methods

A retrospective non-randomized comparative study was conducted on 32 patients aged 18 years or more diagnosed with lumbar or thoracolumbar spondylodiscitis over two years at the Neurosurgery Department of Kafr El-Sheikh University Hospitals and other private and public hospitals in Egypt. From June 2023 – January 2024. After confirming that no other inflammatory processes were present and seeing a positive response to empiric antibiotic treatment, a diagnosis was made for cases where culture results were negative.

Patients were excluded if they were under 18 years old, had spinal infections originating from previous surgical site infections or injections, malignant spinal neoplasms, cervical spondylodiscitis, or were lost to follow-up.

The local ethical committee and Institutional Review Board of the faculty of medicine, Kafr El-Sheikh University, approved the study with ethical ID: KFSIRB200-122. All participants provided informed written consent.

Participants were divided equally into two groups (n=16 each) based on the decision of the consultant neurosurgeon. Group A received conservative management, while Group B underwent transpedicular screw fixation.

Patients who did not exhibit neurological impairments, kyphosis, or other clinical signs of spinal instability were considered for conservative treatment **[15]**. Patients who did not improve after receiving conservative treatment, had signs of uncontrolled infection or worsening pain, had spinal instability (kyphosis >15 degrees), had soft tissue damage, or had neurological compromise were candidates for surgical surgery **[10].**

The patient evaluation included comprehensive history taking, clinical examination, radiological investigations [plain radiographs, computed tomography (CT), and magnetic resonance imaging (MRI)], and laboratory examinations. Pain levels were assessed using an eleven-point visual analog scale (VAS) **[16]**, and functional capacity was measured using the Oswestry Disability Index (ODI) **[17].**

After four weeks of intravenous antibiotic treatment, individuals in Group A were switched to oral antibiotics and continued to take them until their lab and clinical results returned to normal. Group B patients underwent transpedicular screw fixation, involving the placement of screws into the pedicles of the affected vertebrae to provide stability and support to the affected spinal segment.

Follow-up visits were scheduled at one, three, and six months post-intervention for both groups. Changes in VAS and ODI scores were recorded, and any complications were reported, including postoperative complications in the surgical group and the need for surgery in the conservative group. Unsuccessful removal of infection or insufficient alleviation of symptoms was considered treatment failure. Deaths occurring in hospitals as a result of infections or their treatment were categorized as infection-related deaths, whereas recurrence was defined as the return of spondylodiscitis symptoms following the end of antibiotic therapy and the persistence of the same microbe **[18].**

The primary outcome measure was the recurrence rate, while secondary outcomes included changes in post-intervention pain and function, postoperative complications, the requirement for surgical intervention in the conservative group, and the incidence of infection-related death.

Sample size calculation:

Sample size calculation was performed using SPSS Sample Power® version 3.0.1 (IBM® Corp., Armonk, NY, USA). The primary outcome was the incidence of relapse. Based on findings by Valancius et al. **[19],** which reported a 7.4% difference in recurrence between conservative (13.1%) and surgical (20.5%) treatment groups, it was determined that a minimum of 16 patients per group would be necessary to achieve 80% power to detect a 22% difference in relapse or failure rate at a significance level of 0.05.

Statistical analysis:

The statistical analysis was carried out using SPSS v26 (IBM Inc., Chicago, IL, USA). To ensure that the data was distributed normally, a Shapiro-Wilks test and histograms were employed. For quantitative parametric variables, an unpaired Student's *t*-test was used for comparisons between the two groups. For quantitative non-parametric variables, the median and interquartile range (IQR) were used, and the Mann-Whitney test was employed. For qualitative variables, the Chi-square test or Fisher's exact test, as appropriate, were employed. Statistical significance was defined as a two-tailed *p*-value <0.05.

Results

Demographic data were insignificantly different between both groups. Table (1).

VAS and ODI were insignificantly different at pre, 2w, and 1m between both groups and were significantly lower at 3m and 6m in group B than in group A (*p*-value <0.05). Table (2).

Table (1): Demographic data of the studied groups.

	Group A (n=16)	Group B (n=16)	*p*-value
Age (years)	46.94±15.86	45.13±14.72	0.740
Sex:			
Male	9 (56.25%)	11 (68.75%)	0.716
Female	7 (43.75%)	5 (31.25%)	
Weight (kg)	79.56±15.75	82.88±14.99	0.547
Height (cm)	168.88±5.91	167.5±5.49	0.501
BMI (kg/m^2)	28.05±6.07	29.46±4.52	0.461

Data are presented as mean ± SD or frequency (%).
BMI: Body mass index.

Table (2): VAS and ODI of the studied groups.

	Group A (n=16)	Group B (n=16)	*p*-value
	VAS		
Pretreatment	7 (6-7.25)	6 (4-7.25)	0.160
2 week	5 (4-5.5)	4 (3-6)	0.254
1 month	3 (2-3.25)	3 (2-3)	0.445
3 month	4 (3-4.25)	3 (2-4)	0.029*
6 month	4 (3-5)	3.5 (2-4)	0.043*
	ODI		
Pretreatment	58.5±6.28	58.88±7.49	0.879
2 week	54±6.29	52.69±6.87	0.577
1 month	48.69±6.15	44.19±6.85	0.060
3 month	42.63±5.85	36.94±6.66	0.016*
6 month	37.13±6.14	30.81±6.94	0.011*

Data are presented as median (IQR) or mean ± SD.
*: Significant as *p*-value ≤0.05.
VAS: Visual analog scale.
ODI: Oswestry Disability Index.

The recurrence rate was significantly lower in group B than in group A (*p*-value=0.037). Infection was insignificantly different between both groups. Hematoma and bleeding did not occur in any patients in both groups. Table (3).

Table (3): Recurrence rate and side effects of the studied groups.

	Group A (n=16)	Group B (n=16)	*p*-value
Recurrence rate	7 (43.75%)	1 (6.25%)	0.037*
Side effect:			
Hematoma	0 (0%)	0 (0%)	–
Bleeding	0 (0%)	0 (0%)	–
Infection	2 (12.5%)	0 (0%)	1

Data are presented as frequency (%).
*: Significant when *p*-value ≤0.05.

Discussion

Spondylodiscitis presents a significant challenge in spinal pathology, with management strategies ranging from conservative antibiotic therapy to various surgical interventions **[2,7,20].**

Our results demonstrated that while both groups showed initial improvement in VAS scores, significant differences emerged at the 3-month (*p*=0.029) and 6-month (*p*=0.043) follow-ups, with the surgical group (Group B) exhibiting lower median VAS scores. This trend was mirrored in the ODI scores, where Group B showed significantly lower mean ODI scores at 3 months (36.94±6.66 vs. 42.63±5.85, *p*=0.016) and 6 months (30.81±6.94 vs 37.13±6.14, *p*=0.011) compared to the conservative treatment group (Group A).

These findings align with several studies in the literature. El-Sawy et al. **[21]** reported a statistically significant difference in VAS score improvement, favoring surgical fixation over conservative management. Similarly, Giampaolini et al. **[22]** found that at 3 months follow-up, only 10.1% of surgically treated patients reported moderate to severe pain (VAS >4), compared to 54% in the conservatively treated group receiving prolonged antibiotic therapy.

Hosameldin et al. **[23]** reported even more dramatic improvements in their surgical cohort, with VAS scores decreasing from a preoperative mean of 7.3±1.3 to 1±0.85 at 6 months postoperative. While their study focused solely on surgical outcomes without a conservative comparison group, the magnitude of improvement supports the potential benefits of surgical intervention.

Wang et al. **[24]**, using a minimally invasive oblique lumbar interbody fusion technique without instrumentation, demonstrated significant improvements in both VAS and ODI scores. Their reported final follow-up VAS (0.6±0.7) and ODI (8.0±4.6%) scores were notably lower than those in our study, which may be attributed to differences in surgical technique or patient population.

However, it is important to note that not all studies uniformly favor surgical intervention. Stoop et al. **[25]** reported varied long-term outcomes in spondylodiscitis patients, with a mean VAS score of 3.5 at follow-up and 40% of patients reporting VAS scores above 4. Their mean ODI score of 22 suggests that a significant proportion of patients continue to experience moderate disability even after treatment.

The discrepancies in outcomes across studies highlight the complex nature of spondylodiscitis management. Our findings, supported by several other studies, suggest that surgical intervention may offer better pain relief and functional improvement, particularly in the long term.

One of the most striking findings in our study was the significant difference in recurrence rates between the two treatment groups. The conservative treatment group (Group A) experienced a recurrence rate of 43.75% (7 out of 16 patients), substantially higher than the 6.25% (1 out of 16 patients) observed in the surgical group (Group B) (p=0.037). This considerable difference underscores the potential long-term efficacy of surgical intervention in preventing disease recurrence.

Our findings align with the growing body of evidence suggesting that surgical intervention may be more effective in preventing the recurrence of spondylodiscitis. Thavarajasingam et al. **[7]** conducted a meta-analysis comparing early surgical intervention to conservative treatment and found that early surgery was associated with significant reductions in relapse or failure rates. Their analysis revealed a pooled relapse/failure proportion of 15% in the early surgery group compared to 21% in the conservative treatment group, representing a 40% risk reduction (RR 0.60, 95% CI 0.39-0.82, p<0.01).

However, it is important to note that recurrence rates reported in the literature vary widely. Stoop et al. **[25]** reported a relatively low recurrence rate of 6.1% among surviving patients treated for spondylodiscitis, although they did not differentiate between surgical and conservative management in this outcome. Rutges et al. **[2]**, in their systematic review, found that antibiotic treatment alone showed relapse rates of 2-4% in two studies, while surgical treatments had relapse rates varying from 0-10% across different techniques.

The high recurrence rate in our conservative treatment group (43.75%) is notably higher than those reported in most other studies. This discrepancy could be due to various factors, including differences in patient populations, severity of initial infection, duration of antibiotic treatment, or follow-up periods. Susilo **[26]** noted that when antibiotics are administered for less than 4 weeks, the risk of recurrence may be unacceptably high, which could partially explain our findings if our conservative management protocol involved shorter antibiotic courses.

Regarding complications, our study found no significant difference in infection rates between the two groups, with two cases (12.5%) of infection in Group A and none in Group B (p=1.000). This is in contrast to some studies that have reported higher complication rates with surgical intervention. For instance, Dragsted et al. **[20]** reported that 20% of surgically treated patients required reoperation, excluding revision procedures due to complications.

However, our findings are more in line with studies like Janssen et al. **[27],** which found no significant differences in surgical site infections between percutaneous and open surgical approaches. Similarly, Wang et al. **[24]** reported no recurrences and successful bony fusion in all patients treated with their previously mentioned technique, suggesting that certain surgical techniques may offer low complication rates comparable to or even better than conservative management.

While our study focused primarily on pain, functional outcomes, and recurrence rates up to 6 months post-intervention, it is crucial to consider the long-term impact of spondylodiscitis and its treatment on patients' quality of life. Although we did not directly measure the quality of life metrics, the sustained improvements in VAS and ODI scores in our surgical group suggest potential long-term benefits. Tsai et al. **[28]** further supported the benefits of early surgical intervention, reporting significantly lower VAS (mean 0.8 vs. 1.7, p=0.034) and ODI scores (mean 8.8 vs. 14.5, p=0.048) in the early surgery group compared to the antibiotics only group. These findings, along with shorter hospital stays and antibiotic treatment duration in the surgical group, suggest that early surgical intervention may offer superior outcomes in pain reduction, disability improvement, and overall clinical measures.

Several limitations are evident that should be taken into account when interpreting the study's findings. Firstly, the study is constrained by a small sample size, which restricts the statistical power and generalizability of the results. Additionally, the retrospective nature of the study introduces inherent biases, such as selection bias and information bias. The non-randomized allocation of patients into groups, determined by the decision of the consultant neurosurgeon, may further contribute to selection bias. Moreover, the study's single-center design limits its applicability to other healthcare settings or patient populations. The absence of blinding due to the nature of the interventions, could introduce performance and detection biases.

Furthermore, the study may not have fully accounted for potential confounding factors, such as comorbidities or variations in antibiotic regimens. It also exhibits a limited assessment of quality of life. Lastly, the study lacks a cost-effectiveness analysis, which is crucial for informed healthcare decision-making.

Conclusions:

The transpedicular screw fixation may offer superior outcomes in terms of pain relief, functional improvement, and reduced recurrence rates compared to conservative management in patients with spondylodiscitis.

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Conflict of Interest: Nil.

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تثبيت الفقرات القطنية مقابل العلاج التحفظى فى علاج التهاب الغضروف الفقارى

الخلفية: يُشكل التهاب الغضروف الفقارى تحديات كبيرة في إدارة أمراض العمود الفقرى. قام هذا البحث بتقييم النتائج بين العلاج التحفظى وتثبيت الفقرات القطنية فى مرضى التهاب الغضروف الفقارى.

الطريقة: تم إجراء هذه الدراسة بأثر رجعى على ٣٢ مشاركًا يعانون من التهاب الفقار القطنى أو الصدرى القطنى، تم تقسيمهم بالتساوى إلى مجموعتين: المجموعة أ (العلاج التحفظى)، والمجموعة ب (تثبيت الفقرات القطنية). تم استخدام مؤشر الإعاقة أوسويسترى لقياس القدرة الوظيفية، فى حين تم استخدام مقياس شدة الألم لتقييم مستويات الألم. وأجريت المتابعة فى ١ و ٣ و ٦ أشهر بعد التدخل. وكانت النتيجة الأولية هى معدل التكرار، فى حين شملت النتائج الثانوية تغيرات فى الألم والوظيفة، والمضاعفات، والوفاة المرتبطة بالعدوى.

النتائج: كان مقياس شدة الألم و مؤشر الإعاقة أوسويسترى أقل بكثير فى المجموعة (ب) عند ٣ و ٦ أشهر (قيمة ب< ٠,٠٠٥). وكان معدل التكرار أقل بكثير فى المجموعة ب (٦,٢٥ ٪) مقارنة بالمجموعة أ ٤٣,٧٥٪) (ع = ٠,٠٣٧). ولم يكن هناك فروق ذو دلالة إحصائية فى معدلات الإصابة بين المجموعات. لم تحدث أى حالات ورم دموى أو نزيف فى أى من المجموعتين.

الاستنتاجات: أثبت تثبيت الفقرات القطنية نتائج متفوقة فى تخفيف الألم، وتحسين الوظائف، وانخفاض معدلات تكرار مقارنة مع العلاج التحفظى فى مرضى التهاب الغضروف الفقارى. تشير هذه النتائج إلى أن التدخل الجراحى قد يوفر فعالية أفضل على المدى الطويل فى علاج التهاب القرص الفقارى.