

# Surgical Management of Post-Discectomy Spondylodiscitis with Transforaminal Lumbar Interbody Fusion and Posterior Instrumentation

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## ABSTRACT

**OBJECTIVE:** To treat the post-discectomy spondylodiscitis, transforaminal lumbar interbody fusion (TLIF) and the posterior instrumentation performed.

**METHODOLOGY:** This retrospective study was conducted at Khyber Medical College Peshawar from July 2021 to June 2023. Surgery with TLIF and posterior spinal instrumentation was used to treat nine patients (ages 38 to 68; mean ages 47.8 years) having post-lumbar discectomy spondylodiscitis. Despite receiving a thorough conservative treatment plan that included a brace and broad-spectrum antibiotics, every patient still experienced substantial back discomfort. With an average of 22 months, the follow-up lasted between 12 and 36 months. All patients were accessible for the follow-up procedures, including physical examinations, radiography, and function assessment. We looked at the length of the procedure, blood loss, and complications to gauge how invasive it was. The surgical result was assessed using the activities of daily living (ADL) (Barthel index), visual pain analog scale (VPAS), ESR, and CRP in the pre-operative, post-operative, and final follow-up periods.

**RESULTS:** At the last follow-up visit, Barthel and VPAS indices were enhanced in all the patients even though we had experienced some post-operative problems, such as wound infection. In each case, variations in ESR and CRP showed infection suppression.

**CONCLUSION:** Patients experience positive outcomes following surgical management of post-operative spondylodiscitis using TLIF and posterior spinal instrumentation.

**KEYWORDS:** Transforaminal Lumbar Interbody Fusion, Surgical Management Pyogenic spondylodiscitis, Posterior Spinal Instrumentation.

## INTRODUCTION

Turnbull established post-operative spondylodiscitis as a clinical entity for the first time in 1953, making it a very uncommon condition<sup>1</sup>. Post-operative spondylodiscitis was reported to take place after a minimally invasive spinal procedure comprising discectomies, laminectomies, and fusions without or with the instrumentation<sup>2-5</sup>. It accounts for 30.1 percent of all cases of pyogenic spondylodiscitis<sup>6</sup>. It was reported after less invasive treatments such as discography, paravertebral injections, chemonucleolysis, lumbar puncture, and myelography<sup>7-9</sup>. There is debate regarding the best way to handle post-operative spine infections. Most infections following laminectomy or discectomy are managed without surgery using long-term antibiotics<sup>10</sup>. Surgery debridement is typically only performed on individuals who have failed medical treatment for their illness, have neurological damage, an epidural abscess, have unbearable discomfort or an unstable mechanical deformity<sup>11</sup>. Many writers have voiced justified concern about the placement of

instrumentation in patients who are infected because equipment put in for the fusion surgeries otherwise normal individuals was found to increase the rates of post-operative infection<sup>12</sup>. In the past, it is preferred to advise prolonged spinal bracing and bed rest over implantation of internal implants. Others have recommended a tiered technique with an antibiotic therapy time between the instrumentation and debridement steps<sup>13</sup>. The previous series showed outstanding results for the single-stage operations when hardware placement is carried out inside and next to the debrided areas, and these research studies did not reveal noticeably higher infection recurrence rates<sup>14</sup>. Furthermore, it was demonstrated that the transforaminal lumbar interbody fusion (TLIF) produces acceptable results/outcomes and offers better exposure with little risk, mainly in situations where spine surgery repetition is necessary because the presence of the scar tissue made impossible or difficult the traditional posterior lumbar interbody fusion. TLIF appears to be a workable substitute for the anterior lumbar interbody fusion or anteroposterior circumferential fusion<sup>15</sup>.

A TLIF and posterior instrumentation may be beneficial for individuals with spondylodiscitis who are not responding to adequate treatment, as well as those who have neurological deterioration or severe,

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untreatable back pain.

## METHODOLOGY

This retrospective study was conducted at Khyber Medical College Peshawar from July 2021 to June 2023. Sixty individuals with post-discectomy spondylodiscitis were the subjects of this retrospective study. The hospital's institutional review board consented to the study protocol; 45% of the patients were female, and 55% were male. The mean age was 47.8 years, and the age range was 38 to 68. All of our patients underwent open discectomies to treat symptomatic prolapsed lumbar discs, which were made more difficult by infection in the operative disc voids. All cases of the conservative treatment with the bracing and broad-spectrum antibiotics failed. The antibiotic regimen was selected based on empirical considerations to protect against gram-positive, gram-negative, and anaerobic pathogens. Metronidazole and ampicillin were initially given intravenously for the first two weeks. After the CRP returned to normal, oral ciprofloxacin and clindamycin were given. The conservative treatment took an average of 3.3 months (1.5-5.5). The nine patients in the study had substantial low back pain, with an average visual pain analogue scale (VPAS) score of 8.1, despite receiving adequate and sustained conservative treatment (range: 6-10). In each case, simple radiography showed that the disc space was becoming smaller and that the surrounding endplates were eroding and becoming sclerotic. Therefore, TLIF, posterior instrumentation, and one stage of surgery were used to treat those individuals.

The patients were thoroughly examined before surgery, and radiological information, including plain and MRI radiographs, was analyzed. Additionally, laboratory tests for erythrocyte sedimentation rate (ESR; mm/h), C-reactive protein (CRP; mg/dl), and white blood cell count (WBC; count/mm<sup>3</sup>) were carried out. Patients were assessed for their ability to perform activities of daily living (ADL) using the Barthel Index, which has been used since the 1960s due to its high validity and reliability, and their level of back pain using the VPAS.

The procedure's invasiveness was assessed by computing the surgical time and blood loss and recoding the problems. Patients were mobilized wearing a semi-flexible lumbosacral brace during the first few post-operative days. Depending on the culture and sensitivity test findings, each patient received a 6-week course of antibiotics (intravenous for three weeks and oral for three weeks). If not, any organism was found, the pre-operative empirical antibiotic course was kept up. ESR and CRP measurements were made weekly during 1<sup>st</sup> six weeks (during antibiotics) and then again at each follow-up appointment. At 6-week intervals, then 3, 6, 12, 24 and 36 months after surgery, plain radiography, VPAS, and Barthel Index were evaluated. It was possible to follow up with every patient. (Range: 12-

36) The average time of follow-up was 22.20 months.

## **Surgical technique**

The patient was positioned on their side. An autologous posterior iliac cancellous bone graft was initially collected, and the incision was closed to prevent cross-contamination. A midline longitudinal incision allows for the exposure of the posterior spinal components. The muscles (paraspinal) are done to transverse processes by a subperiosteal dissection. Before, pedicle screws were sized, decompression, and placed under x-ray guidance of the C-arm to achieve distraction and reduction of blood loss. An inferior facetectomy and unilateral laminectomy were used to access the spinal canal.

Conversely, the ligamentum flavum and interspinous ligament are both still intact. Identification and protection of the exiting nerve root. If necessary, the thecal sac is gradually withdrawn medially. Through the use of this unilateral method, a discectomy is conducted. All infected and necrotic discs and bone tissue were removed through radical debridement, and the samples were then sent for sensitivity testing and culture. After initial discectomy, the pedicle screws on the other side are gradually distracted. Up until bleeding bone is reached, flat endplate surfaces are achieved using an osteotome. The interbody space is then filled with bone transplant before distraction is let go. Construct is squeezed to create the interface of the ideal graft bone and restore the lumbar lordosis. It tightens the system rod screw. After sufficient decortication, the bone graft is applied over transverse processes to form a circumferential fusion.

## **Case presentation**

After an open discectomy, a 38-year-old farmer has developed the L4/L5 spondylodiscitis. MRI results confirmed the diagnosis. After eight weeks of bracing and full-dose broad-spectrum antibiotics, the CRP returned to normal. Still, the patient continued to complain of back pain that was getting worse with nighttime exacerbations and making it difficult for him to go about his regular activities. Repeated inflammatory indicators indicated that the infection had returned. His ESR at the first hour was 64, and his final CRP testing was 38. The following procedures were carried out: the debridement of disc space, TLIF along with autologous iliac bone transplant, and the posterior instrumentation with the system of titanium pedicle screw. After 2.5 years of follow-up, the patient had a good fusion, significant relief from his back discomfort, and no infection return.

## **Statistical Methods**

Data from the intra-operative, post-operative, and pre-operative stages were gathered and kept in a single database on a computer. The range, mean, and frequencies of the data were statistically described. Post and pre-operative means were compared to determine significance using the paired "t" test. SPSS version 22 was used for statistical calculation.

## RESULTS

Both the Bantel index and VPAS significantly improved. At the most recent follow-up, ESR and CRP recovered to normal or almost normal (**Table I**). 0.74 litres of blood were lost on average (range: 0.5-1.2). The typical length of an operation was 165.5 mins (ranges from 120 to 240). The pus samples were cultured taken during the surgery revealed *Escherichia coli* in one instance, *Klebsiella* in one case, *Staphylococcus aureus* in five cases, no growth of bacteria in two cases, and the *Staphylococcus aureus* in five cases. In all cases, there hasn't been any metalwork failure, infection recurrence, or residual infection. In each example, adequate radiological fusion was accomplished.

### Post-operative Complications

One patient experienced a transient L5 nerve root palsy that went away on its own after about four months. A wound infection in one more patient was treated in the 3-weeks with the repeated dressing changes in the addition of regularly prescribed medications. There are no additional significant issues with the procedure.

**Table I: Comparison of post-operative and pre-operative means of evaluating parameters**

	Post-operative		Pre-operative		p
	Range	Mean	Range	Mean	
<b>Barthel index</b>	80-100	94.4	30-60	42.2	< 0.001
<b>CRP</b>		< 6	38-66	51.4	
<b>VPAS</b>	0-3	1.3	06-10	8.1	
<b>ESR</b>	10-30	17.3	64-120	95.75	

## DISCUSSION

Nearly every open and minimally invasive spinal treatment has been linked to post-operative spondylodiscitis, which accounts for roughly 30.1% of all instances of pyogenic spondylodiscitis. Minor infections are often self-limited and will go away independently in most individuals without needing treatment. Because back discomfort following spinal surgery occurs frequently, there may frequently be a delay in diagnosis. Some investigations have indicated incorrect diagnoses in the patient population due to a lack of interest in the infection as a potential cause<sup>16</sup>. Patients might seek guidance in a different place because their back discomfort worsens, so the precise follow-up and the incidence of reported instances might be inaccurate. Despite this, it was noted that the risk of developing post-operative spondylodiscitis following any spinal operation varies from 0.26% to 20%. From 0.6% to 3.7% after the discectomy to 3.7% to 20% following the posterior instrumented fusion, the incidence and severity typically rise with the sophistication of the treatment<sup>17</sup>. This explains why only nine cases over two years were recruited for this investigation.

Most researchers believe an offending microbe is injected into the avascular disc region. However, the specific cause of post-operative spondylodiscitis is still up for debate<sup>18</sup>. According to some writers, there are two types of spondylodiscitis: the aseptic form, which is brought on by an inflammatory response, and the septic form, which an infectious agent brings on. Others contend that aseptic spondylodiscitis does not exist and results from a low-grade, less virulent infection<sup>19</sup>. After vaccination, the infection and discitis processes start. The primary organism that causes the disease is frequently unknown. *Staphylococcus aureus* was the most frequent infectious etiologic agent when an organism was found, followed by the other species of *Staphylococcus* and anaerobic organisms<sup>20</sup>. Other less frequent organisms include fungi, *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus viridans* and other *Streptococcus* species, as well as others. We decided not to perform a CT-guided biopsy because all patients in this study come from low socioeconomic backgrounds, and it was challenging to identify the etiological organism. Instead, we gave the patients empirical broad-spectrum antibiotics effective against aerobic and anaerobic pathogens.

According to reports, only 42.6% of cases of spondylodiscitis have high WBC levels<sup>21</sup>. Because of this, although WBC was measured as part of the usual blood investigations, we did not include it as an outcome measure in this study. The CRP and ESR are the most sensitive laboratory tests suggesting an inflammatory process. However, it should be emphasized that concomitant medical conditions can complicate ESR trends in adults. It is noted, though, that in adults, the trends of ESR are complicated by comorbid medical problems and non-specific rate rise that frequently comes with ageing. However, the ESR was a helpful tool in treating adult pyogenic spondylodiscitis. Most research on this condition considers a 50% - 66% drop in ESR consistent with infection eradication<sup>22</sup>.

The ESR decreased by 82%, according to a recent study. Spondylodiscitis can be detected on plain radiographs; however, these symptoms are typically less sensitive and appear later than physical exam findings and laboratory indicators. The intervertebral disc space loss of height is the first simple radiographic indication frequently seen between the sixth and fourth post-operative week. Also, vertebral end plates below and above the diseased disc may become blurry or cloudy. More sensitive tests include CT scanning, MRI with gadolinium, and radionuclide investigations. With reported specificity and sensitivity of 97% and 93%, respectively, the MRI is a radiographic imaging technique for detecting post-operative spondylodiscitis. It has been demonstrated that MRI can diagnose post-operative discitis more accurately than both technetium 99 and gallium 67 bone scans, and it can spot disc alterations earlier than CT<sup>23</sup>. Post-operative normalization of ESR and

CRP values should be used to confirm the complete elimination of the infection. Concurrent medical problems and inflammatory reactions to surgery significantly impact these values trends. The use of follow-up MRI may also be beneficial; however, the interpretation of these images was complicated by enhanced non-infected granulation tissue and hardware errors. Numerous experts have decided to advise prolonged spinal bracing and bed rest as spondylodiscitis treatments instead of surgical intervention. Others have suggested performing the surgery in stages, with an antibiotic treatment period between the debridement and instrumentation steps. Historically, only those with an epidural abscess were eligible for open surgical drainage for spondylodiscitis. The prognosis is good when therapy starts as soon as infection occurs<sup>24</sup>.

Avoiding the insertion of hardware in debridement cavities has no clear advantages. The infrequent cases of anteriorly positioned graft extrusion show that fixation shall be used whenever possible. The grafts in the inter-body are commonly used in individuals having spinal osteomyelitis. A study described autologous interbody bone grafting for chronic spinal osteomyelitis for the first time, and it has been used safely ever since<sup>25</sup>.

Most studies that describe single-stage spinal infection operations involve anterior debridement, allograft or autograft placement, and posterior stabilising device installation. This strategy is predicated on the idea that the instrumentation positioned posteriorly entails a second operational field that was not polluted immediately. Fountain released the first report in which this tactic was employed. Fountain reported a mixed group of patients, and both posterior stabilizations with Harrington rods and anterior corpectomy and fusion were used to treat the infection. A study reported the first series in 1988 that detailed the constant placement of the posterior instrumentation at the time of debridement. Using an expandable titanium cage for anterior debridement and rebuilding and a pedicle screw/rod construct for posterior fixation<sup>26</sup>.

Because the anterior column bears 80% of the weight on the lumbar spine, rebuilding the posterior column for spondylodiscitis attracted a lot of interest because it compresses inter-body grafts and increases the likelihood of the fusion. A distinct method for the posterior instrumentation may be used for the anterior lumbar inter-body fusion, which frequently necessitates the presence of surgeon access<sup>15</sup>. The posterior tension band at the fusion level is lost with posterior lumbar interbody fusion (PLIF), which requires bilateral exposure. It reduces the bony surface for posterior fusion, necessitates extensive retraction of the neural elements, and, more importantly, cannot be done safely in a revision case due to the development of scar tissue, especially in spondylodiscitis<sup>27</sup>. A study invented a revised PLIF technique, TLIF 1982, to provide a secure fusion in a

one-step procedure. It offered various advantages over more conventional methods by entering the disc and spinal canal through a channel that travels via the far-lateral part of the vertebral foramen. Additionally, because only minor retraction of nerve roots and the dural sac is necessary, there is a much lesser chance of neurological damage following surgery<sup>28</sup>. TLIF exclusively uses the posterior technique to complete a circumference fusion in a single level.

To the best of our knowledge, the literature has not yet discussed the application of the TLIF approach in the management of spondylodiscitis cases. A solid circumferential fusion can be achieved while achieving debridement, accessing the disc space, avoiding the frightened zone, and avoiding a more challenging approach anteriorly. While it might be regarded as technically difficult, this study has proven that the average operating duration, average blood loss, and average complication rate are appropriate. Additionally, the positive outcomes made this procedure perfect for treating post-operative spondylodiscitis. This study's inability to enrol a bigger patient group due to its intense emphasis on a particular community is one of its limitations.

## CONCLUSION

These findings show that TLIF, which provides good post-operative stability, appropriate debridement, and permits a single-stage circumferential fusion by a single posterior method, is an effective treatment technique in patients with post-operative spondylodiscitis. A feasible extension of this work would be to apply the outlined method to all spondylodiscitis cases.

**Ethical permission:** Khyber Medical College Peshawar Pakistan IRB letter No. 446/DME/KMC.

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**Data Sharing Statement:** The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

## AUTHOR CONTRIBUTION

Sardar SB: Principal investigator, manuscript writing  
 Khan MA: Statistical analysis  
 Khan MI: Manuscript editing  
 Khan Q: Data collection

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