

Fusion with Stabilization for the Treatment of Post-operative Lumbar Spondylodiscitis: Our Experience

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Abstract

Objective: To analyse the outcome of fusion with stabilization for the treatment of postoperative lumbar spondylodiscitis.

Background: Post-operative spondylodiscitis is a dreadful complication following disc surgery. Treatment option is either conservative or operative, but till date, there are no universally accepted treatment protocol. Many studies suggest early surgical intervention provides good outcome. Different mode of surgical interventions can be applied for its treatment like debridement only, debridement followed by fusion with or without stabilization. In this study, we treat all of our patients having post-operative spondylodiscitis by fusion with stabilization.

Materials & methods: Retrospectively we reviewed 20 cases from January 2016 to July 2021 in Bangabandhu Sheikh Mujib Medical University and other private hospitals of Dhaka, Bangladesh. Post-operative spondylodiscitis was diagnosed according to history, specific clinical findings, laboratory and radiographic investigations. Surgery was the treatment of choice in our cases. Pre and postoperative evaluations were done by the Visual Analog scale (VAS), Nurick score for neurological outcome, Modified Kirkaldy-Willis criteria for functional outcome and Modified Lee's criteria for fusion assessment.

Results: Total number of patients was 20. Mean age was 48 years (range 22-83). Average follow-up period was 12 months. The period between the surgery and the onset of symptoms was 14 to 28 days. Pre-operative VAS score was 8.10 ± 1.7 and post-operatively was 1.7 ± 0.6 at the last follow-up ($P < 0.001$). Pre & post-operative Nurick score was 2.7 & 0.7. Functional outcome was assessed in our study by Modified Kirkaldy-Willis criteria which shows 90% patient have satisfactory outcome while 10% have unsatisfactory outcome. Modified Lee's criteria show definitive fusion in 55%, probable fusion in 35% & possible pseudarthrosis in 10% cases.

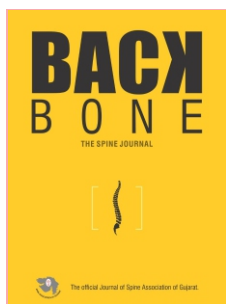
Conclusion: Early diagnosis and proper management are the keys to successful outcome of postoperative spondylodiscitis. Surgical management in the form of fusion and transpedicular fixation can give excellent results.

Keywords: Spondylodiscitis, Fusion, Stabilization

Introduction

Post operative spondylodiscitis is the primary infection of intervertebral disc with secondary involvement of the vertebral endplate and body after spinal surgery. It was first described by Turnbull in 1953 as a clinical entity [1, 2]. In majority of cases,

it occurs due to direct inoculation of virulent organisms during surgery and less commonly via haematogenous spread. Spinal infections can be pyogenic, granulomatous (tuberculosis, brucellosis, or fungal) or parasitic [2]. The incidence of postoperative spondylodiscitis varies from 0.21–3.6% [3, 4]. Patients of postoperative spondylodiscitis usually presented with recurrent or persistent severe back pain and fever after a spinal surgery. ESR and CRP are important marker which are usually raised in these patients and provide a high index of suspicion thus helps in early diagnosis. Among the radiological diagnostic tools, MRI is the most valuable tool to detect postoperative spondylodiscitis specially in early stage where infected disc space appears as hypointense signals on T1- and hyperintense signals on T2- weighted images [5]. X-



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Submitted: 03/03/2022; Reviewed: 23/03/2022; Accepted: 12/05/2022; Published: 01/10/2022

Back Bone: The Spine Journal (The Official Journal Of "Spine Association of Gujarat") | Available on www.backbonejournal.com | DOI:10.13107/bbj.2022.v03i02.045
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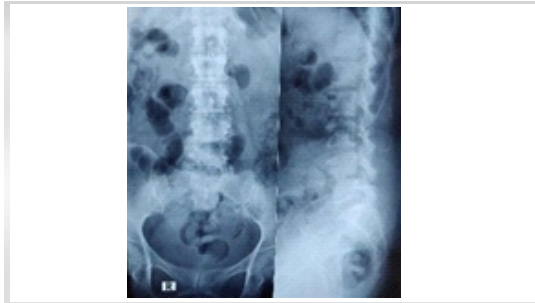


Figure 1: X-ray L-S spine A/P & lateral view showing L4-5 spondylodiscitis

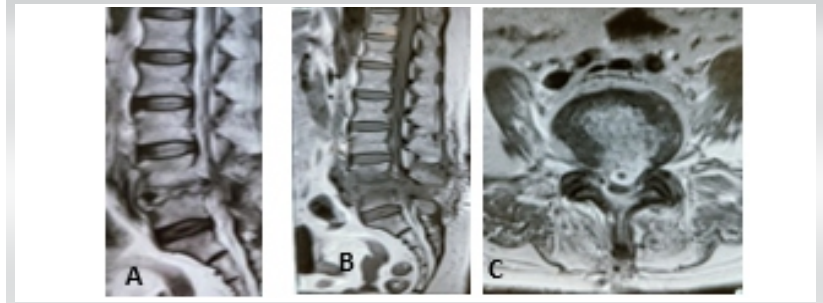


Figure 2: Magnetic resonance imaging showing destruction of L4-5 intervertebral disc. (A) Sagittal MRI T2 Image, (B) Sagittal MRI T1 Image and (C) Axial MRI Image



Figure 3: Per-operative picture showing stabilization by pedicle screws & rod.

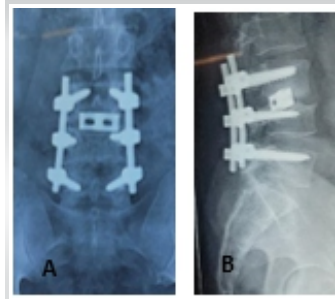


Figure 4: 6 month's post-operative X-ray showing fusion at L3-4 level. A: A/P, B: Lateral view

ray and CT scan may be normal in early stage but may show loss of disc height, erosion in vertebral body at late stages of spondylodiscitis [6].

Management of post-operative spondylodiscitis can be either by conservative or by surgical means. Surgical management is usually indicated when medical management fails; or when there is progressive neurological compromise, instability and deformity due to significant endplate erosion or intractable pain. Mode of surgical interventions includes debridement of infected tissues, neural decompression, and fusion with or without spinal stabilization [7].

The aim of this study is to analyse the outcome of fusion with stabilization for the treatment of postoperative lumbar spondylodiscitis.

Materials & methods

This is a retrospective study conducted on 20 patients with the diagnosis of postoperative spondylodiscitis presented in the spine unit of orthopaedic surgery department of Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka and other private hospitals of Dhaka, Bangladesh from January 2016 to July 2021.

The cases were diagnosed clinically for post-operative spondylodiscitis and supported by radiological imaging and laboratory findings. Details history of previous spinal surgery and thorough clinical examination was done to all patient. MRI with contrast (Gadolinium) enhancement was the imaging of choice for diagnosing spondylodiscitis. Haematological markers like ESR, CRP, leucocyte count etc. were done to diagnose as well as in the follow-up period.

Once the diagnosis of post-operative spondylodiscitis is made, Surgery was the treatment of choice in our cases. Surgical techniques performed are: removal and debridement of the infected, necrotic tissues with thorough toileting and curettage of the affected end plates, specimen collection for microbiological as well as histopathological analysis, interbody fusion by banana (Titanium) cage with autogenous bone grafts and stabilization by titanium pedicular screws & rods. Broad spectrum antibiotics were given after surgery until culture and sensitivity report was available and antibiotics were adjusted accordingly. We treat all patients with intravenous antibiotics for 2 weeks followed by 6 weeks of oral antibiotics.

Pre and postoperative evaluations were done by the Visual Analog scale (VAS), Nurick score for neurological outcome, Modified Kirkaldy-Willis criteria was used to assess the functional outcome and for fusion assessment modified lee's criteria was used. IBM-SPSS V26 software was used for statistical analysis where p value was used as cut-off (<0.001). Patients, those managed conservatively and surgically other than debridement and fusion with stabilization were excluded from the study. All post-operative spondylodiscitis patients were treated by same spine surgeon. The mean follow-up period was 12 months post-operatively.

Surgical procedure:

Surgery was performed with the patient under general anaesthesia with endotracheal intubation and in the prone position (knee chest position with abdomen hangs free). Posterior midline longitudinal incision was made through the previous scar. From the margin of the residual lamina, previous surgery's epidural scar tissue was separated and then, normal anatomic planes was accessed by removing the residual lamina. After careful exposure of the neural structures like the dura, nerve roots, were exposed, the posterior longitudinal ligament was lifted out carefully and the affected disc was exposed. Then all the visible inflammatory tissues along with endplate cartilage, were debrided up to healthy bleeding bone. Wound & disc space was cleaned thoroughly by normal saline mixed with gentamicin. Then interbody fusion with titanium banana cage and autogenous cancellous bone graft was done depending on

Patient characteristics	
Sex	
Male	13
Female	7
Age (years)	40.5±10.5
Level of primary surgery	
L3/4	3
L4/5	10
L5/S1	7
Co-morbidity	
Diabetes mellitus	5
Obesity	1
Chronic kidney disease	2
Clinical presentation	
Back pain	20(100%)
Leg pain	09(45%)
Mean follow-up (months)	12 months
Period between surgery and onset of symptoms	14-28 days

Table 1: Demographic characteristics of patients (n=20)

Score (VAS)	Pre-operative (mean ±SD)	Post-operative after 1 year (mean ±SD)	P value
Back pain	8.10±1.7	1.7±0.6	<0.001
Leg pain	5.4±1.1	2.1±0.6	<0.001

Table 3: Pre-operative and post-operative comparison of pain after 12 months (n=20), According to VAS score

Score	Pre-operative	Post-operative
Nurick	2.7	0.7

Table 4: Pre-operative and post-operative Nurick Score (n=20)

Blood parameters	
Mean ESR (mm in 1st hour)	
Pre-treatment	62.11±15.23
Post-treatment	
4 weeks	25.32±3.81
3 months	19.79±4.31
6 months	14.05±2.71
12 months	11.60±1.20
Pre- vs post-treatment at 12 months p value	<0.001
Mean C-reactive protein (mg/L)	
Pre-treatment	70.84±22.93
Post-treatment	
4 weeks	38.37±6.47
3 months	13.17±3.20
6 months	10.46±3.13
12 months	5.31±2.13
Pre- vs post-treatment at 12 months p value	<0.001
By blood culture and CT-guided aspiration	
Total organism	9 (45%)
Staph. aureus	6 (66.6%)
Staph. epidermidis	2 (22.2%)
E. coli	1 (11.11%)
Tissue biopsy (aspiration & per-operative)	Mixed inflammatory cells. No granuloma.

Table 2: Inflammatory markers, blood culture, aspiration and tissue biopsy results

the vertebral body destruction, collapse and kyphotic deformity. Stabilization was done by pedicular screws & rods. Representing tissue samples excised at the time of surgery were sent for microbiological as well as histopathological analysis. Patients were encouraged to ambulate on the 5th to 7th post-operative day.

Results

Mean patient age was 48 (22–83) years. Among them, 13 were men and seven were women, and mean follow-up was 12 (8–16) months. Patient demographics, microbiological isolates, neurological presentation, medical comorbidities and clinical outcomes are illustrated in Table 2. All patients have single disc

involvement that corresponds with the level of surgery. L3-4 was involved in 3 cases, L4/5 level was involved in 10 patients and L5/S1 level was involved in 7 patients. Severe back pain is the initial presentation in all 20 patients. Five patients presented with fever higher than 102°F. The surgical site skin incision appeared to be normal in all patients, except local erythema, swelling, or a draining sinus were seen in three patients. Two of them resolved within 10 days after local debridement but one required secondary closure on 14th post-operative day. Five patients were diabetic, one patient was morbidly obese (body mass index >35) and two patient had chronic kidney disease. Inflammatory markers (e.g. ESR and CRP) were increased in all patients and within 6 weeks post-

Excellent	11 (55%)
Good	7 (35%)
Fair	2(10%)
Poor	00(0%)
Satisfactory	18(90%)
Unsatisfactory	02(10%)

Table 5: Functional outcome according to modified Kirkaldy-Willis criteria

Grade	Description
Definitive fusion	11(55%)
Probable fusion	7(35%)
Possible pseudarthrosis	2(10%)
Definite pseudarthrosis	0(0%)

Table 6: Modified Lee's criteria for assessing fusion

treatment it was nearly normal in all patients. In blood culture and CT-guided aspiration, 45% cases revealed the causative organism where Staphylococcus aureus was significant. Biopsy report did not reveal any granulomatous lesion. Intravenous antibiotics were given for two weeks followed by six weeks of oral antibiotics based on the culture & sensitivity report. All patients were evaluated through laboratory tests, local examination and X-rays. The pre-treatment mean (\pm SD) VAS score was 8.10 (\pm 1.7) and post-treatment mean (\pm SD) VAS score was 1.7 (\pm 0.6) and the P value was <0.001. According to modified Kirkaldy-Willis criteria [26], excellent result was significant (55%) whereas overall satisfactory rate was also significant. Radiologically, fusion was assessed by modified Lee's criteria [26] and revealed definitive fusion in 11 cases (55%), probable fusion in 7 cases (35%), possible pseudarthrosis in two case (10%) and definite pseudarthrosis in zero case (0%).

Results & Discussion

Postoperative spondylodiscitis is a disastrous complication of disc surgery, associated with significant morbidity. The majority of surgeons opines that it results from direct inoculation of an infectious pathogen into the avascular disc space. Vertebral end plate injury, collection of hematoma, and necrotic tissue caused by surgery provide favourable culture conditions for bacterial growth. Most of the studies showed that it could be due to bacterial causes [8, 9]. Wide variety of organisms are responsible for post-operative spondylodiscitis, among them most common is Staphylococcus Aureus (60%) followed by Staphylococcus epidermidis and anaerobic

organisms. Other less common organisms include Streptococcus viridians, Escherichia Coli, Pseudomonas Aeruginosa, Mycobacterium tuberculosis, fungus (candida, aspergillus) and others [12]. In our study by blood culture and CT-guided aspiration from the disc space total 45% organisms were isolated, among them mostly (66.6%) were Staphylococcus Aureus [Table: 2]. In our study, 20 patients had post-operative spondylodiscitis over a period of 5 years with an average of 3–4 cases/year. Ahmad and Yasin [10] reported an incidence of 6 case/year. In our study, most cases of discitis belonged to the 40 to 55 years age group. The period between the surgery and the onset of symptoms was 14 to 28 days which was similar to other study [16]. Clinical presentation in most of the cases in our study was similar to the existing literature [17, 18]. The characteristic symptoms in our cases were severe increasing back pain, fever and radicular pain. Diagnosis of post-operative spondylodiscitis based on a brief history, thorough clinical examination, detailed laboratory studies and imaging studies. Persistent elevated ESR and CRP along with typical radiological findings suggests discitis. Some studies indicate that CRP is the most sensitive indicator of post-operative spondylodiscitis [19, 20]. All 20 patients in our study had increased CRP and ESR which declines significantly within 4 weeks that supported the previous studies.

The management of discitis is challenging and it is a matter of controversy [22] and there is no universally accepted treatment protocol. Many of the patients of post-operative spondylodiscitis can be managed by conservative means by immobilization (bed rest and orthosis) and analgesic along with intravenous antibiotic therapy [13, 14, 15]. But due to the high rates of complications like pseudarthrosis, long cure time of inflammation, and the risks of prolonged bed rest required to immobilize the affected spinal segment, conservative therapy for the management of spondylodiscitis is recently not considered the standard treatment unless there is contraindication of surgery[23, 24].

We did surgical debridement, fusion by cage and autogenous cancellous bone graft and fixation using trans-pedicular screws and rods in all cases. Fixation is advocated as instability cannot be assessed properly in these patients because of severe pain and muscle spasm [19]. Singh et al shows that instrumentation after radical debridement immediately stabilizes the affected segment and promotes healing [19].

Regarding back pain control according to VAS was 8.10 \pm 1.7 preoperatively and significantly decreased to 1.7 \pm 0.6 at the last follow-up (P< 0.001). This corresponds to the study of Jain et al. [21]. In our series the, pre & post-operative Nurick score was 2.7 & 0.7 which was satisfactory for the patients.

Functional outcome was assessed in our study by modified Kirkaldy-Willis criteria which shows 90% patient have

satisfactory outcome while 10% have unsatisfactory outcome which is nearer to the study of Lee et al. [11]
Radiological fusion was assessed by modified Lee's criteria. It shows definitive fusion in 55%, probable fusion in 35% & possible pseudarthrosis in 10% cases which is nearer to the study of Pramod et al [14].

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Conclusion

Early diagnosis and appropriate prompt treatment can eradicate the infection and limit damage to local tissues, including the neural elements. Though there are many debates regarding the management for post-operative spondylodiscitis, early surgical intervention preferred in most of the studies. This study shows that early surgical intervention in the form of fusion with stabilization can be considered as an effective treatment modality in the management of post-operative spondylodiscitis which provides better functional outcome by early ambulation, good control of pain, and early hospital discharge and return to daily activities.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Islam MA, Mahbub W, Saha S, Islam AI | Fusion with Stabilization for the Treatment of Post-operative Lumbar Spondylodiscitis: Our Experience | Back Bone: The Spine Journal | October 2022-March 2023; 3(2): 84-89.