Integrated Approach for Management of Spondylodiscitis: Surgical and Medical Approach

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ABSTRACT

Introduction: Spinal infections, constituting a small percentage of musculoskeletal infections, often necessitate surgical intervention combined with antimicrobial therapy in advanced stages for effective management and improved patient outcomes. The study aimed to share experiences in managing severe and complicated spondylodiscitis (SD) using a combined approach of antibiotics and surgery and offer recommendations to improve care for challenging SD cases. **Methods:** The study took place at J P Orthocare Hospital, Ahmedabad, Gujarat, India, focusing on SD patients admitted within a year. It included 21 patients undergoing SD surgery, where experienced spine surgeons performed debridement, histopathological examinations, and culture tests. Antibiotic treatments were based on culture reports and infection specialist recommendations. Neurological status, fusion status, graft position, and instrumentation alignment were monitored using standardized assessments and SPSS 20.0 for statistical analysis ($p < 0.05$). **Result:** The study revealed a male predominance (6:1 ratio) among patients, primarily from Ahmedabad district, with lumbosacral vertebral involvement being most common, particularly at L4-S5 (28.57%). Mycobacterium tuberculosis (Rifampin sensitive) was the most prevalent pathogen, followed by Methicillin-resistant Staphylococcus aureus (MRSA) and Pseudomonas. Transformational lumbar interbody fusion with bone graft was the most frequent procedure (28.58%), with patients typically discharged after 72 hours post-surgery after culture and sensitivity report obtained and starting antibiotic after consulting infection specialist. **Conclusions:** The combined surgical and medical treatment of severe SD enables effective debridement, rapid inflammation resolution, early mobilization, and shorter antibiotic courses. Both tuberculous and pyogenic SD showed improvement. A holistic strategy for multimorbid patients, addressing perioperative health concerns and ensuring extended follow-up, improves management results and patient welfare.

Keywords: Spondylodiscitis, Antibiotics, Lumbar Interbody Fusion, Tuberculosis, Surgery

Introduction

Spinal infections constitute about 2–7% of total musculoskeletal system infections. Pathogens can infect the spine through haematogenous dissemination, direct infection, or extension through adjacent infected tissue, with the haematogenous spread being the most common, facilitating the transmission of infections to vertebral column from remote locations.[1, 2]

Various pathogens can cause these infections, such as bacteria, fungus, or parasites. Staphylococcus aureus being the leading microorganism, making up roughly 50% of non-tuberculous infection cases. The remaining occurrences of spinal infections are primarily caused by Mycobacterium tuberculosis.[3]

Early on in the course of spondylodiscitis (SD), when it presents without neurological deficits, advanced bony destruction, or failed medical treatment, conservative management with antimicrobial therapy and immobilization is typically effective. However, as the infection progresses, leading to complications such as skeletal deformity, neurological deficits, and sepsis (severe SD), conservative management often fails. In these situations, debriding contaminated tissue, obtaining specimens for microbiology and histological evaluation, decompressing the canal of the spinal cord, and achieving bone stability by fusion all require surgery combined with appropriate antibiotic therapy.[4-6]

Despite these guidelines, the management of SD remains contentious among major spine centres worldwide due to the heterogeneous nature of the patient population, comparable rates of illness and mortality for surgical and conservative interventions, and evidence suggesting that surgical treatment in uncomplicated SD may lead to quicker mobilization, and more rapid recovery than with conservative treatment.[7-9]

This study aimed to disseminate our understanding in treating those cases suffering from severe and complex SD, who were treated with an integrated approach using both antibiotics and surgery combined. We aimed to analyse the patient cohort and correlate our findings with other studies. Our goal was to provide recommendations to improve the standard of care given to patients with complicated SD.

Material and Method

This study was conducted at J P Orthocare Hospital Ahmedabad, Gujarat, India focusing on patients with SD admitted over a year, from January 2022 to December 2023. The criteria for admitting patients with SD included medical comorbidities, neurological impairment, fever, sepsis upon presentation, elderly age, imaging signs of bone instability and degeneration, an MRI showing an epidural abscess, and ongoing SD in spite of conservative treatment. The twenty-one patients who underwent SD surgery during this time period were all included. All patients gave their informed consent, and anonymity was upheld in line with the Helsinki Declaration's fundamental principles. Strict adherence to ethical norms and standard norms for clinical study conduct were maintained.

Each case of SD was extensively discussed by the spine surgeons and management was decided by unanimity. Patients with additional health issues impacting SD management or outcomes received immediate attention from other specialties, such as Infectious Diseases, Nephrology, Gastroenterology, Cardiology, Internal Medicine, or Anaesthesiology, to optimize their condition preoperatively. This multidisciplinary approach was maintained throughout the treatment phases to enhance overall outcomes.

Expert spine surgeons carried out the surgical procedures, which included careful debridement of the diseased tissues, sample collection for histological analysis, culture and sensitivity checking, and either bone fusion or decompression of the nerve structures. The patient received antibiotics based on the culture and sensitivity report also, findings and recommendations provided by the infection

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specialist were incorporated. Patients already on antibiotics continued them postoperatively until histopathology and/or culture results guided specific antibiotic therapy.

Most patients were discharged after 72 hours post-surgery after culture and sensitivity report obtained and starting antibiotic after consulting infection specialist. Neurological status was closely monitored throughout the hospital stay and follow-up visits using standardized assessments. Radiological assessments included fusion status, graft position, and instrumentation alignment, serial ESR and CRP monitors in follow up visit which was gradually decreased. Using SPSS 20.0 software, statistical analysis was carried out, with confidence set at $p < 0.05$. Mean for continuous parameters (such as age) were obtained, and aggregated values were tested using chi-square test.

Result

Table 1 details sociodemographic variables among the spondylodiscitis cases. With a gender ratio of 6:1, males made up the greatest number of cases. Most patients were came from Gujarat; few patients were reported from Rajasthan also.

Figure 1 shows the distribution of spinal levels affected in cases of SD. The most common site affected was the lumbosacral vertebral column, specifically L4-S5 (n=6, 28.57%), followed by the lumbar, cervical, and dorsal spine, in that order.

Table 2 details the microorganisms detected in Tissue cultures of SD cases. The most common organism identified was Mycobacterium tuberculosis (Rifampin sensitive), followed by Methicillin-resistant Staphylococcus aureus (MRSA) followed by Pseudomonas.

Table 3 provides details of the surgical management of SD cases. The most common procedure performed was Transforaminal Lumbar Interbody Fusion (TLIF) (n=6, 28.58%), followed by vertebral fusion. Other procedures such as decompression, debridement, and discectomy were also performed as needed. Images 1-4 are showing pre and postoperative radiological findings of patient having L5-S1 Spondylodiscitis whose blood culture positive for brucella. This patients received antibiotics treatment consisting of Amikacin injection for 1.5 months, along with Doxycycline 100 mg capsules twice daily, Ciprofloxacin 500 mg tablets BD Rifampin 600 mg tablets OD for a duration of 6 months

Table-1 Sociodemographic variables among study cases.

Variable	N	%
Age, Mean ± SD	58.07 ± 17.81	
Gender		
Males	18	85.71
Females	3	14.29
Residence		
Ahmedabad	11	52.38
Banaskantha	2	9.52
Mehsana	1	4.76
Porbandar	1	4.76
Rajasthan	3	14.29
Sabarkantha	1	4.76
Surendranagar	1	4.76
Visnagar	1	4.76
Total	21	100.00

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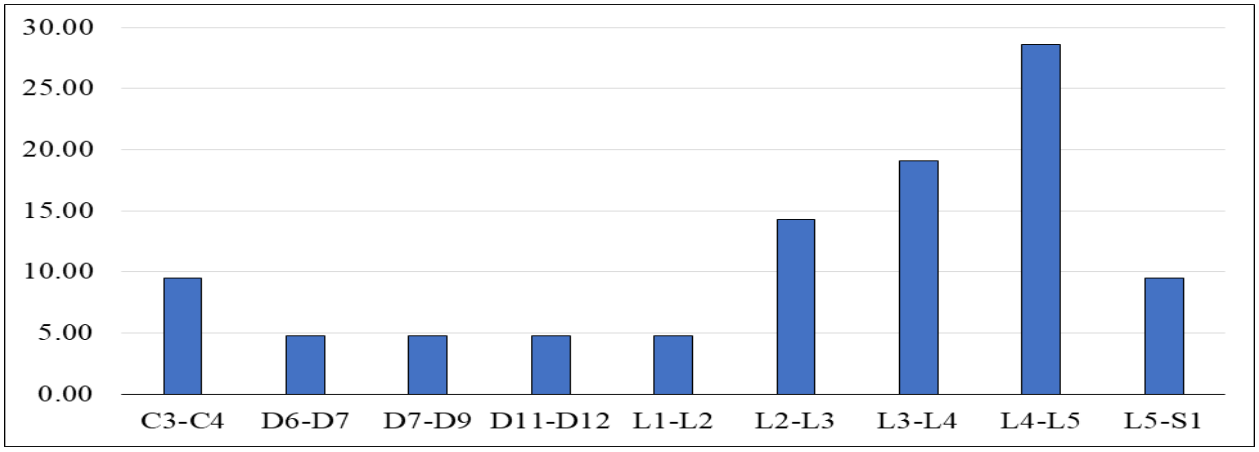

Figure 1: Distribution of Spinal level affected in Spondylodiscitis cases (%)

Table 2: Microorganism detected in Blood Culture in Spondylodiscitis cases

Microorganism	n	%	P Value
Mycobacterium tuberculosis	6	28.57	0.17
Staphylococcus aureus	4	19.05	
Pseudomonas	3	14.29	
No organism detected	2	9.52	
Acinetobacter baumannii	1	4.76	
Aspergillus nidulans	1	4.76	
Brucella	1	4.76	
Brucellosis	1	4.76	
Burkholderia cepacia	1	4.76	
Escherichia coli	1	4.76	
Total	21	100.00	

Table 3: Details of surgical management in Spondylodiscitis cases.

Surgery	n	%	P Value
L3-L4 TLIF	3	14.29	0.98
L4-L5 TLIF	3	14.29	
C3-C4 Anterior Cervical Discectomy And Fusion	2	9.52	
D5-D8 Posterolateral Fusion	1	4.76	
D6-D10 Fixation	1	4.76	
D11-L4 Fixation	1	4.76	
& D10 To L1 Fixation	1	4.76	
L3-L4 Posterolateral Fusion	1	4.76	
L3-L4 TLIF	1	4.76	
L4-L5 Fixation With Three Level TLIF, D12-L1 Level Revision Surgery	1	4.76	
L4-L5 Microdiscectomy	1	4.76	
Debridement Discectomy L4-L5 & TLIF	1	4.76	
L1-L4 Posterolateral Fusion Fixation	1	4.76	
L3-L5 Posterolateral Fusion	1	4.76	
L2-L3 TLIF With PEEK CAGE	1	4.76	
L2-L3 + L3-L4 TLIF and L4-L5 Posterolateral Fusion	1	4.76	
Total	21	100.00	

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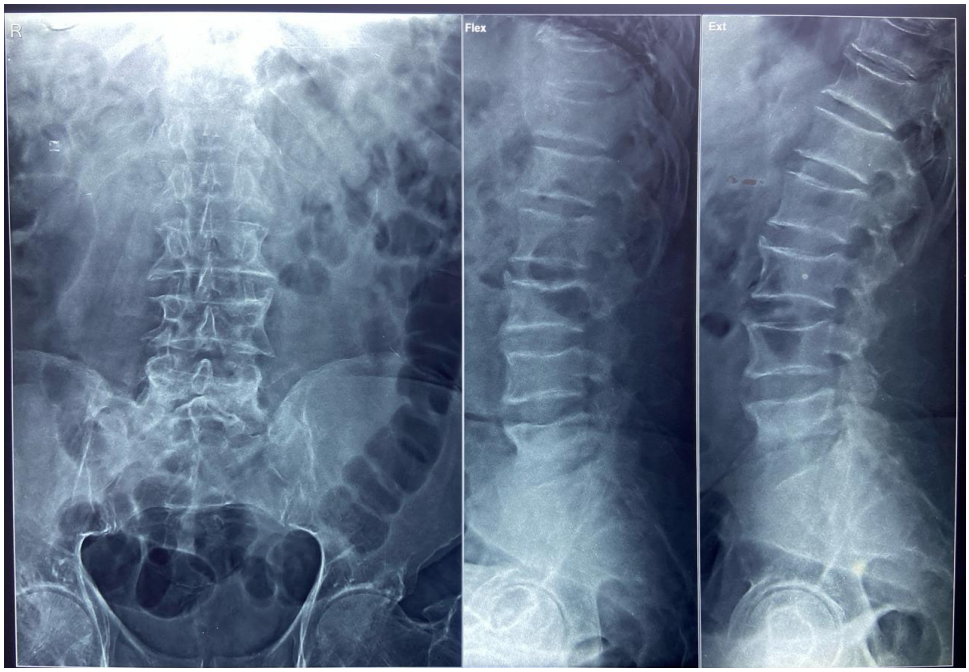

Image 1: Preoperative X-ray

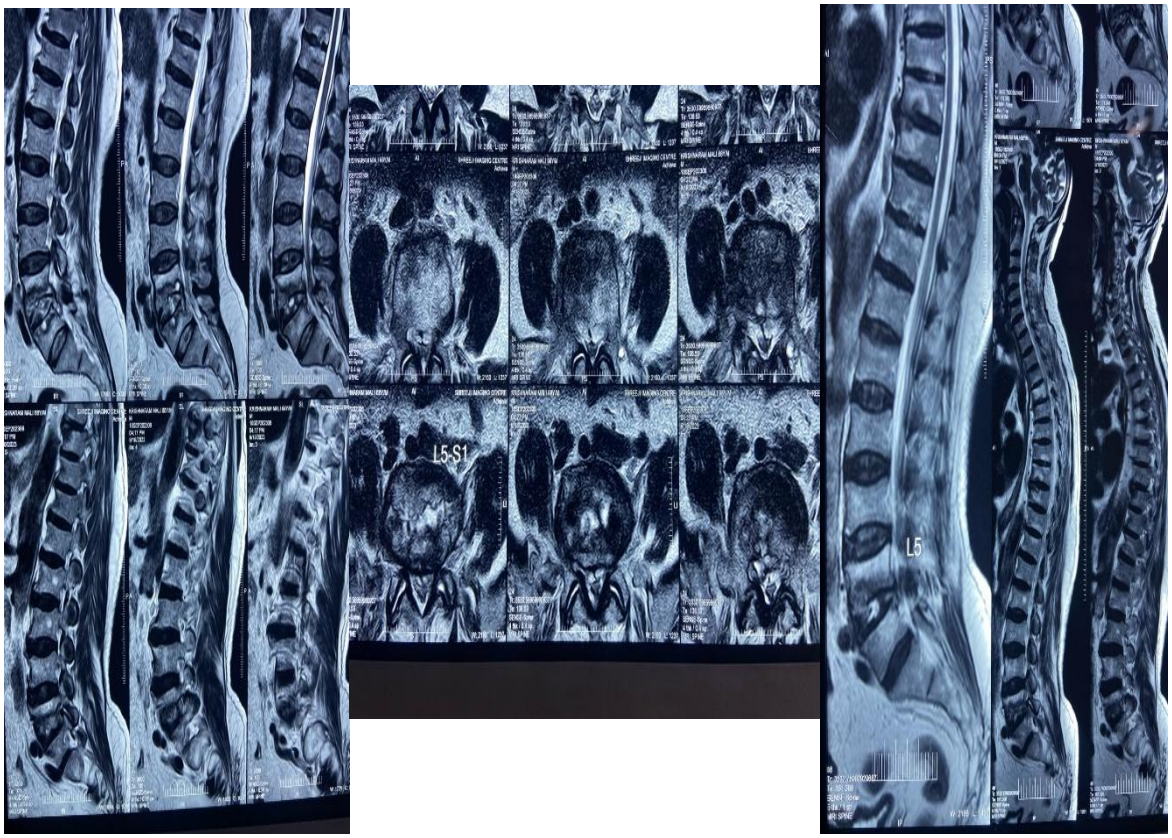

Image 2: Preoperative MRI Scans

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Image 3: Postoperative X-ray (on the day of surgery)

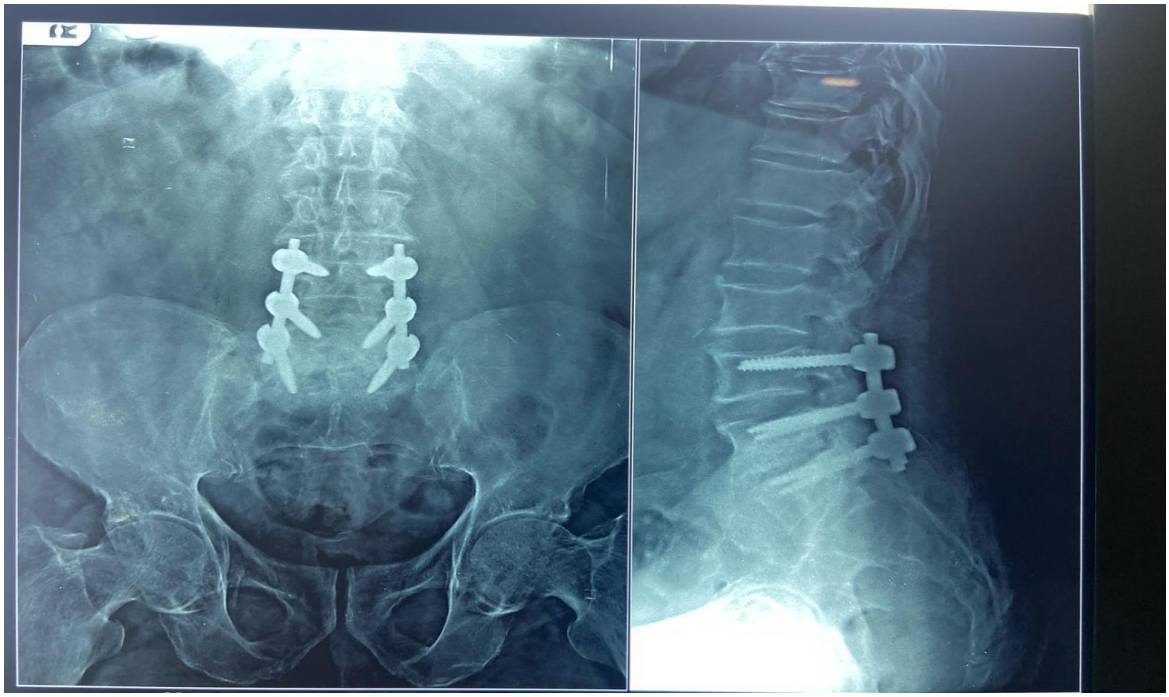

Image 4: Postoperative X-ray (6 months after surgery)

Discussion

All patients who have clinical features of SD, whose ESR, CRP and MRI suggestive of SD included in the study. In addition, patients of SD were investigated for culture report after debridement and treated with antibiotics specific to the infecting organism along with spinal immobilization. Patients of SD are typically managed on either OPD basis or indoor basis depending upon the response to the treatment.

Patients referred to our centre often have advanced stages of the disease and indications for surgery due to factors such as age and presence of multiple significant health problems. These factors frequently decrease the feasibility of conservative treatment with prolonged use of antibiotics due to factors such as compromised organ function, patient compliance issues with external immobilization methods, and the chances of increased side effects accompanying prolonged usage of broad-spectrum antibiotics.[10]

Surgical intervention, in contrast to conservative measures, offers a quicker and safer way to reduce inflammation, allowing for earlier mobility post-surgery. Diagnostic imaging techniques used in our study included plain X-ray, MRI, and CT scans, with each serving specific roles in patient evaluation. Surgical objectives encompassed extensive tissue debridement, microbiological and histological sample collection, spinal canal decompression, paravertebral abscess drainage, spinal alignment restoration, and stabilization through instruments and/or fusion.[11-13]

Several prior investigations have noted that culture and sensitivity outcomes might yield negative results in as much as 70% of disc space infection cases, with a reported range spanning from 30% to 70%.[14-16] This variability could be attributed to several factors, including the scenario where many of such patients arrive at tertiary care centres already receiving antibiotic treatment, which can potentially distort the results of this valuable diagnostic test. Even though only two of the twenty-one patients in our study had negative results from culture and sensitivity tests, the results of the histopathological examination were successfully used as an indirect guidance for the diagnosis and the subsequent antimicrobial therapy.

Antibiotic therapy and its duration varied based on administration route (IV and oral), with antibiotic selection tailored to histopathological findings and culture/sensitivity results when available. Despite challenges such as the impact of comorbidities on outcomes and mortality rates, careful preoperative assessment, multidisciplinary care, efficient surgical techniques, and postoperative monitoring were recommended to enhance long-term outcomes and survival rates.[17-19] In this study, the empirical antibiotics administered were customized to target Gram-negative organisms as well as methicillin-resistant strains (MRSA) of Staphylococcus aureus, in line with current guidelines.[19,20]

We strongly advocate for a meticulous preoperative assessment conducted by Spine Specialists, coupled with the management of concurrent medical conditions through a multidisciplinary team approach. Efficient surgical techniques, coupled with thorough postoperative monitoring that not only evaluates surgical outcomes but also addresses potential advancements in accompanying chronic diseases, are essential. Patients affected by this serious condition might greatly improve their future outcomes and rates of survival through integrating input from other medical or surgical departments.[21]

Although this study had limitations such as a short follow-up duration and a heterogeneous patient population, its focus was to reflect the integrated management practices of our hospital and compare them with approaches used in other centres, with an emphasis on effectively managing both pyogenic and tuberculous SD despite their differing causative organisms and pathogenesis.

Conclusion

The integrated surgical and medical management of SD permits for operative debridement, prompt resolution of inflammation, early patient mobility, and a significantly lesser period of antibiotics use. Both pyogenic as well as tuberculous SD showed improvement following adequate surgery and antibiotics. In order to improve treatment outcomes and a long-term patient well-being, a multidisciplinary strategy should be used to treat multimorbid patients with this condition, address additional medical problems perioperatively, and provide both immediate as well as long-term follow-up.

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