ORIGINAL ARTICLE

CLINICAL AND MICROBIOLOGICAL CHARACTERISTICS OF PYOGENIC SPONDYLODISCITIS: A RETROSPECTIVE STUDY

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ABSTRACT

Introduction: Pyogenic spondylodiscitis (PS) incidence is rising globally, but microbial profiles vary significantly by region. Local data is crucial for effective empirical therapy. This study aimed to analyze the clinical and microbiological characteristics of microbiologically confirmed PS cases at a tertiary hospital in Kathmandu, Nepal.

Method: We retrospectively reviewed 19 patients with culture-positive PS treated at Manmohan Memorial Teaching Hospital from January 2017 to December 2024. Data on demographics, comorbidities, inflammatory markers (CRP/ESR), pathogen identity, treatment modality, and clinical outcome were collected. Statistical analysis was performed using SPSS.

Result: The mean age was 58.8±15.4 years, and 78.9% were male. Neurological deficits were observed in 7 patients (36.8%). Lumbar/Dorso-lumbar spine involvement was most common (63.2%). Mean initial C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR) were 148.6±50.3 mg/L and 68.7±11.2 mm/h, respectively. The dominant pathogens were Staphylococcus aureus (47.4%) and *Escherichia Coli* (31.6%). Surgical intervention was required in 52.6% of patients. The overall clinical success rate was 94.7%.

Conclusion: The high prevalence of Gram-negative organisms, particularly E. Coli and endemic pathogens like Salmonella typhi, mandates that local empirical antibiotic protocols in Nepal ensure adequate coverage for Gram-negative bacilli. Aggressive, pathogen-specific treatment leads to excellent outcomes in this population.

Key words: **Pyogenic Spondylodiscitis(PS)**

INTRODUCTION

Pyogenic spondylodiscitis (PS) is a severe bacterial infection involving the intervertebral disc space and adjacent vertebral bodies, often leading to spinal instability, neurological deficit, and systemic sepsis1. While rare, its incidence has been rapidly increasing globally; reports indicate a rise of over 100% in incidence in recent decades.[3]

This increase is often attributed to factors such as an aging population, rising rates of immunosuppression, and increased use of spinal instrumentation2. The diagnosis of PS remains challenging as clinical presentation can be nonspecific, often mimicking common causes of back pain. Delays in diagnosis and treatment are common and directly correlate with poor clinical outcomes and increased mortality.[4]

The gold standard for definitive diagnosis involves culturing tissue obtained via biopsy or surgery, allowing for pathogen-directed antibiotic therapy. Worldwide, the microbiology of PS is dominated by Staphylococcus aureus (Gram-positive), typically accounting for over 50% of isolates. However, the prevalence of Gram-negative organisms, specifically Escherichia coli and Klebsiella species, varies significantly based on geographic region, patient comorbidities (like diabetes mellitus), and local healthcare practices.[5]

In the context of Nepal, the microbiological profile and clinical trends for PS remain insufficiently documented in international literature6. Understanding the locally dominant pathogens is paramount for formulating effective empirical antibiotic guidelines, especially considering the prevalence of endemic diseases such as enteric fever and brucellosis.[7]

This study aims to retrospectively analyze the clinical and microbiological characteristics of all microbiologically confirmed cases of pyogenic spondylodiscitis managed at Manmohan Memorial Teaching Hospital (MMTH) over an eight-year period, defining the local pathogen distribution and correlating findings with patient outcomes.

METHODS

Study Design and Patient Selection

This was a retrospective study reviewing the medical records of patients diagnosed and treated for pyogenic spondylodiscitis at Manmohan Memorial Teaching Hospital, Kathmandu, Nepal, from January 2017 to December 2024.
Inclusion Criteria: Patients of any age with a clinical and radiological diagnosis of spondylodiscitis who underwent a biopsy or surgical debridement of the affected spine segment and had a positive microbiological culture (pus or tissue) confirming the infectious etiology.

Exclusion Criteria: Patients with tuberculous spondylitis, fungal infections, or culture-negative spondylodiscitis.
A total of 19 patients met the strict inclusion criteria for this study.

Data Collection

Clinical data were extracted from electronic and paper medical records. Collected variables included demographic data (age, sex), comorbidities (e.g., diabetes mellitus), duration of symptoms, location of involvement (cervical, thoracic, lumbar, etc.), presenting neurological status, initial laboratory markers (C-Reactive Protein CRP, Erythrocyte Sedimentation Rate ESR), treatment modality (medical-only vs. surgical intervention), and final clinical outcome.

Microbiological and Laboratory Analysis

All microbiological data were obtained from the hospital's laboratory records. Pus or tissue samples obtained from the spine (via percutaneous biopsy or surgery) were processed immediately for Gram stain, culture, and sensitivity testing. Standard aerobic culture techniques were used. Elevated inflammatory markers were defined as initial ESR ≥50 mm/h and initial CRP ≥10 mg/L.

Treatment and Outcome Measures

Surgical intervention was indicated for patients with progressive neurological deficits, spinal instability, or failure of conservative antibiotic therapy. All patients received a

minimum of six weeks of targeted intravenous and/or oral antibiotics guided by sensitivity testing. Clinical success was defined as the resolution of pain (Visual Analog Scale VAS score decrease or maintaining VAS ≤3) and inflammatory markers returning to normal or near-normal range at the final follow-up.

Statistical Analysis

Descriptive statistics were used to summarize the data. Continuous variables (e.g., age, CRP, ESR) were reported as mean ± standard deviation (±SD) and range. Categorical variables (e.g., sex, pathogen distribution) were reported as counts and percentages (%). Statistical analysis was performed using SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Inferential analysis between categorical variables, such as neurological status and surgical intervention, was performed using the Fisher's Exact Test due to the small sample size. A p-value of <0.05 was considered statistically significant.

RESULTS

Patient Demographics and Baseline Characteristics

A total of 19 patients with microbiologically confirmed pyogenic spondylodiscitis were included in this retrospective analysis. The mean age of the cohort was 58.8±15.4 years (range: 28 to 86 years). 15 patients (78.9%) were male. The mean duration of symptoms prior to definitive diagnosis was 32.4±29.5 days. Seven patients (36.8%) presented with a neurological deficit, including weakness or paraplegia.

Table 1. Patient Demographics, Clinical Presentation, and Laboratory Data (n=19)

Characteristic	Value	Percent (%)
Demographics		
Mean Age ±SD (years)	58.8±15.4	-
Male Gender (n)	15	78.9
Comorbidities		
Diabetes Mellitus (n)	5	26.3
History of Remote Infection (n)	3	15.8
Clinical Presentation		
Mean Symptom Duration ±SD (days)	32.4±29.5	-
Neurological Deficit at Presentation (n)	7	36.8
Spine Location		
Lumbar/Dorso-lumbar (n)	12	63.2
Thoracic (n)	6	31.6
Cervical (n)	1	5.3
Inflammatory Markers		
Mean CRP ±SD (mg/L)	148.6±50.3	-
Mean ESR ±SD (mm/h)	68.7±11.2	-

Microbiological Profile

All 19 patients had a positive culture obtained from spinal pus or tissue. Gram-positive organisms (primarily S. aureus) accounted for 9 cases (47.4%), while Gram-negative bacilli (GNB) accounted for 10 cases (52.6%), including mixed infections.

The most frequently identified single causative organism was *Staphylococcus aureus*, isolated in 9 patients (47.4%). The second most common single pathogen was *E. Coli*, identified in 6 patients (31.6%). Two cases (10.5%) were mixed Gram-negative infections, and two cases (10.5%) were endemic GNB pathogens. Detailed susceptibility patterns showed a 0% rate of MRSA or ESBL resistance in this cohort.

Figure 1. Distribution of Causative Pathogens in Pyogenic Spondylodiscitis (n=19)

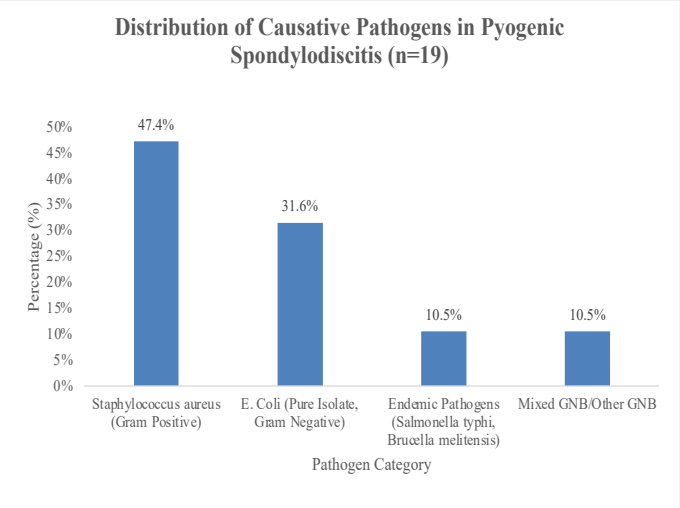
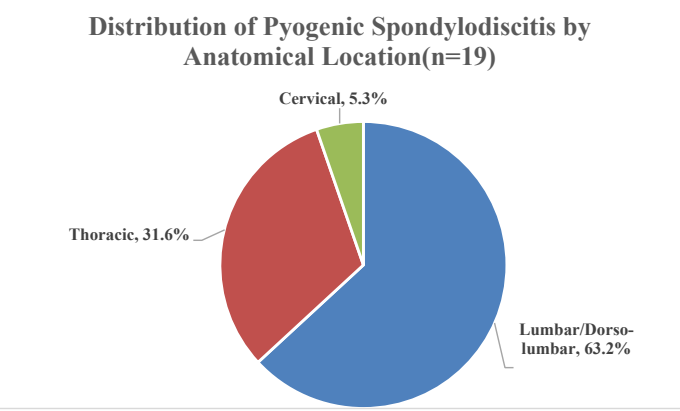


Figure 2. Distribution of Pyogenic Spondylodiscitis by Anatomical Location



Treatment and Outcome

A total of 10 patients (52.6%) required surgical intervention (decompression, instrumentation, or debridement) in addition to antibiotics, while 9 patients (47.4%) were treated primarily with prolonged intravenous antibiotics. The overall clinical success rate was 94.7%.

Association between Neurological Deficit and Surgical Management

To evaluate factors influencing the choice of surgical versus medical management, we assessed the association between the presence of a pre-operative neurological deficit and the need for surgery. The distribution was as follows:

Table 2. Distribution of Neurological Deficit with Medical and Surgical Management (n=19)

Distribution of Neurological Deficit	Medical Management (n=9)	Surgical Manage-ment (n=10)	Total (n=19)
No Deficit	7	5	12
Deficit	2	5	7
Total	9	10	19

Although 71.4% of patients presenting with a neurological deficit required surgery (5/7), Fisher's Exact Test indicated no statistically significant association between pre-operative neurological status and the need for surgical management (p=0.218). The odds ratio was 0.35 (95% CI: 0.02,2.76).

DISCUSSIONS

This retrospective study provides an analysis of the clinical, microbiological, and outcome characteristics of 19 patients with microbiologically confirmed pyogenic spondylodiscitis managed at a tertiary center in Kathmandu, Nepal, between January 2017 and December 2024. Our cohort, defined by a strict criterion of positive spinal pus or tissue culture, confirms several global trends while highlighting significant local microbiological specificities that impact empirical treatment guidelines.

Patient Demographics and Clinical Presentation

The mean age of patients in our study (58.8±15.4 years) is consistent with international literature, where pyogenic spondylodiscitis is typically a disease of the elderly, often occurring in the sixth and seventh decades of life8. The strong male predominance (78.9%) and the high prevalence of lumbar/dorso-lumbar involvement (63.2%) (Figure 2) are also universally recognized features10. A critical finding in our cohort was the high rate of neurological deficit at presentation (36.8%), which is significantly higher than the 10-20% reported in many global studies9. This suggests that delays in diagnosis or referral may be more common in our setting, leading to advanced presentation.

Microbiological Profile: High Gram-Negative Prevalence

The microbiological findings represent the most distinguishing feature of our cohort. While Gram-positive *Staphylococcus aureus* remains the single most common pathogen (47.4%), aligning with global data[11], the collective proportion of Gram-negative bacilli (52.6%), primarily E. Coli (31.6% pure isolates), is remarkably high (Figure 1). In many Western cohorts, *E. Coli* incidence is typically lower (below 15%), whereas its high prevalence in our study, often associated with urinary tract infections or intra-abdominal sources, strongly suggests a significant difference in the route of primary infection or local environmental factors.[12] This high GNB rate necessitates a lower threshold for incorporating broad-spectrum antibiotics with good Gram-negative coverage in the initial empirical management of suspected pyogenic spondylodiscitis at our institution.

Identification of Endemic and Uncommon Pathogens

The isolation of *Salmonella typhi* and *Brucella melitensis* (total 10.5%) is highly relevant to the context of Nepal. Given the endemic nature of enteric fever and brucellosis in the region, these atypical pathogens must be considered in the differential diagnosis, especially in patients without a clear focus of infection.[7] These findings underscore the limitations of relying solely on Gram stain and culture results and emphasize the need for a comprehensive diagnostic workup, including serology for atypical pathogens, in the local setting.[14]

Management and Outcomes

The treatment distribution in our cohort was evenly split, with 52.6% requiring surgical intervention. Despite the high proportion of surgical cases and the high rate of pre-operative neurological deficit, the overall clinical success rate was excellent (94.7%). Our inferential analysis, however, showed no statistically significant association between presenting with a neurological deficit and requiring surgical management (p=0.218). This is likely due to the small sample size, but clinically, the tendency for deficit patients to require surgery (71.4% in our study) remains a critical consideration for clinical decision-making.

Limitations

The primary limitation of this study is its small sample size (n=19), which limits the power of inferential statistical analysis, as evidenced by the non-significant p-value for the association between neurological status and surgery. Furthermore, as a retrospective study, it is subject to potential documentation bias. Despite these limitations, the specific microbiological profile provides a valuable, high-confidence snapshot of the pathogens prevalent in Nepal.

CONCLUSION

This retrospective study on microbiologically confirmed pyogenic spondylodiscitis at Manmohan Hospital confirms the utility of aggressive management, yielding an excellent clinical success rate of 94.7%. Crucially, the findings reveal a high regional prevalence of Gram-negative organisms, particularly ***E. Coli***, and the presence of endemic pathogens such as *Salmonella typhi* and *Brucella melitensis*. These observations mandate that local empirical treatment protocols in Nepal should include adequate coverage for Gram-negative bacilli until definitive culture results are available. Future prospective studies with larger cohorts are needed to further define the utility of surgical versus non-surgical management pathways in the Nepalese population.

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