1133

Clinical Experience Treating Vertebral Osteomyelitis at University of Louisville Hospital

Julie Harting, PharmD[1,2], Francisco Fernandez, MD[1], Kim Buckner, BA[1], Rob Kelley, PhD[1], Paula Peyrani, MD[1], Julio Ramirez, MD[1]

[1]Division of Infectious Diseases, University of Louisville School of Medicine and [2] Sullivan University College of Pharmacy, Louisville, KY

ABSTRACT

Background: At University of Louisville (UofL) we implemented a multidisciplinary Bone and Joint (B&J) Infection Service. The primary objective of this study was to review our experience treating adult patients with vertebral osteomyelitis and compare findings to the IDSA Practice Guidelines. A secondary objective evaluated annual trends in IVDU and incidence of vertebral osteomyelitis.

Methods: This was a retrospective, observational study of patients managed by the B&J service at UofL Hospital from January 2011 to April 2016. For clinical outcomes, patients who deteriorated during antibiotic therapy or relapsed after completing therapy requiring surgical intervention were considered failures. Outcomes were assessed at end-of-treatment, 30-days, and 12-months.

Results: A total of 91 patients were reviewed; the median age was 56 years (range 19-82), and 55 were male. Relevant history and comorbid conditions include diabetes (35), IVDU (27), Hepatitis C (20) with cirrhosis (5), and smoking (49). Documentation of IVDU increased from 10% to 50% of patients annually from 2011 to 2015. Infection was most common in the lumbar vertebrae (47). *Staphylococcus aureus* was the infecting pathogen in 53 (59%) cases. Fifty-three (58%) patients had concurrent bacteremia, and 10 (11%) were diagnosed with endocarditis. Epidural abscess was present in 51 (56%) cases. Sixty-six (73%) underwent surgical intervention; hardware was added in 24 patients. At end-of-treatment, 22 patients were lost to follow-up. Sixty-two (90%) were considered clinical success and 30 continued long term suppressive treatment for retained hardware. Seventy-eight patients were eligible for 12-month outcomes, but 38 were lost to follow-up. Of the remaining 40 cases, 10 died, and twenty-eight (70%) were considered clinical success.

Conclusion: Our study suggests that vertebral osteomyelitis is highly curable, IVDU is a primary risk factor, and *Staphylococcus aureus* is the most common pathogen; which is consistent with the IDSA Practice Guidelines. However, presence of epidural abscess was much more prevalent in our patient population. Empiric antimicrobial selection, while waiting on imaging and culture results, should utilize intravenous agents that penetrate into the epidural space.

INTRODUCTION

- Osteomyelitis is an infection of the bone and/or marrow. Treatment durations are long, requiring a minimum of 4-6 weeks, and high-dose intravenous antibiotic therapy is the standard of care.[1,2]
  - Native vertebral osteomyelitis (NVO) describes 3-5% of all cases.[3]
- The 2015 IDSA Vertebral Osteomyelitis Practice Guidelines focus on adults with NVO. Prior studies identify common characteristics among this patient population such as hematogenous etiology with bacteremia up to 50% of the time, monomicrobial infection predominantly caused by *Staphylococcus aureus*, back pain and elevated inflammatory markers with or without a fever, and concurrent paravertebral or epidural extension [abscess] in 46% of patients.[3,4]
- Risk factors for NVO include elderly and immunocompromised patients, IVDU (intravenous drug users), hemodialysis patients and those with indwelling catheters, and recent instrumentation.[3]
- For antimicrobial treatment of NVO, six weeks of intravenous or high-bioavailable agents is recommended (strong, low). IV to PO switch during therapy can be considered. Treatment success has been documented in up to 90% of cases.[3]
- At University Hospital, hospital admissions among IVDU patients are dramatically increasing annually. Subsequently, infectious disease consultation for serious infectious complications (bacteremia, endocarditis, vertebral osteomyelitis, and complicated skin soft tissue infection) has also increased.
  - Louisville, KY is located 35 miles from Austin, IN, an epicenter for the 2015 HIV and Hepatitis C outbreak affecting roughly 25% of that population.

STUDY OBJECTIVES

Primary Objective:

- Compare clinical experience treating adults with vertebral osteomyelitis to the 2015 IDSA Vertebral Osteomyelitis Practice Guidelines

Secondary Objective:

- Evaluate local trends associating IVDU and vertebral osteomyelitis

METHODS

Study Design:

- Retrospective, observational study of adults (age ≥18) diagnosed with vertebral osteomyelitis between January 2011 and April 2016
- IRB approval for the study of bone & joint infections was obtained
- Data obtained using the BAJIO (Bone And Joint Infection Organization) database, a multi-center database of patients diagnosed with osteomyelitis, prosthetic joint infection, or septic joint by the B&J Service at University of Louisville

Inclusion Criteria:

- Diagnosis of osteomyelitis confirmed by:
  - Imaging: X-ray, CT, MRI, and/or nuclear medicine studies, or
  - Histologic evaluation of the bone, or
  - Microbiological evidence: positive bone or blood culture

Study Definitions:

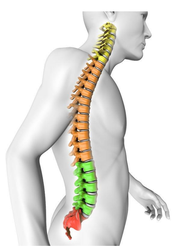
- Clinical Success
  - No clinical or microbiological evidence of infection at end-of-treatment or 12-months
- Clinical Failure
  - Clinical or laboratory deterioration during treatment, or relapse of infection within 12 months following treatment

Statistics:

- All statistical tests were performed using Microsoft Excel
- Median and interquartile ranges were used for continuous data
- Frequency and percentage were used for categorical data

RESULTS

- A total of ninety-one vertebral osteomyelitis patients were reviewed.
- Fifty-nine cases were acute (65%).
- Etiology was deemed hematogenous in forty-five (49%) cases.
- Contiguous etiologies include:
  - Adjacent skin soft tissue infection (n = 36, 40%)
  - Spinal steroid injections (n = 6, 7%)
  - Post-surgical (n = 26, 29%)
  - Prosthetic-related (n = 31, 34%) *hardware present at diagnosis



- The lumbar region was the most common
  - Cervical: n = 26 (29%)
  - Thoracic: n = 32 (35%)
  - Lumbar: n = 47 (52%)
  - Sacral: n = 15 (16%)
- Multiple spinal regions of the spine were involved in twenty-six (29%) patients.
- Epidural abscess was present in fifty-one (56%) patients.

RESULTS (Cont'd)

Table 1: Patient Demographic and Baseline Characteristics

	(n = 91)
Age (years), median (IQR)	56 (45,63)
Male sex, no. (%)	55 (60)
Race Caucasian, no. %	77 (85)
Weight (kg), median (IQR)	77 (68,94)
Comorbid Conditions, no. (%)	
Diabetes	35 (39)
Acute or Chronic Kidney Disease	16 (18)
Tobacco Use, current or prior	49 (54)
IVDU, history of	27 (30)
Viral Hepatitis	20 (22)
Prior hospital admission ≤30 days	54 (60)
Concurrent endocarditis	10 (11)
Concurrent bacteremia	53 (58)
Antimicrobial Usage, no. (%)	
Duration of Therapy (days), median (IQR)	45 (42,56)
IV only	70 (77)
IV + PO in combination	3 (3)
IV, then PO switch	15 (16)
PO only	3 (3)
Laboratory values at baseline, median (IQR)	
WBC (cells/mm^3)	10.4 (7,16)
ESR (mm/hr)	72 (48,101)
CRP (mg/L)	100 (43,155)
Presence of fever at diagnosis	48 (53)

Table 2: Pathogens

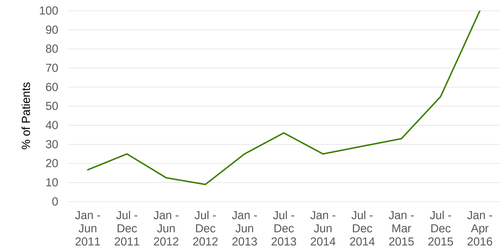
Pathogens, no. (%)	(n = 91)
Polymicrobial Infection	11 (12)
Gram positive pathogens	
Staphylococcus aureus (MSSA)	24 (26)
Staphylococcus aureus (MRSA)	29 (32)
Staphylococcus, coagulase-negative species	5 (5)
Streptococcus anginosus	5 (5)
Streptococcus, other species	5 (5)
Enterococcus	3 (3)
Gram negative pathogens	
E. coli	6 (7)
Other Enterobacteriaceae species	5 (5)
Anaerobes (*Bacteroides, Prevotella, Fusobacterium*)	8 (9)
Candida species	1 (1)
Culture-negative infection (when culture was obtained)	14 (15)

Clinical Outcomes

- Sixty-nine patients were included in end-of-treatment analysis. Twenty-two (24%) were excluded due to loss of follow-up.
  - Clinical success at end-of-treatment was achieved in 62 (90%) patients.
  - Five patients died, and two were failures.
  - Twenty-nine (42%) patients continued on long-term suppressive therapy for retained hardware.
- At 12-months, clinical outcomes were as follows:
  - Forty-nine patients were included in outcomes analysis; 38 (42%) patients were lost to follow-up, and 4 patients had not reached the 12-month timepoint.
  - Clinical success was achieved in thirty-four (69%) patients.
  - Thirteen patients died, thus all-cause mortality was 27%.

RESULTS (Cont'd)

Figure 1: Percentage of IVDU Patients Per 6-month Analysis



Comparison with 2015 IDSA Vertebral Osteomyelitis (NVO) Guidelines

- Similarities
  - *Staphylococcus aureus* was the most common pathogen, 58% of cases.
  - Blood cultures were useful to guide pathogen-directed therapy in 53%.
  - Inflammatory markers (ESR, CRP) were elevated in most patients.
  - 77% were treated with IV alone, and 16% received an IV to PO switch. Common PO switch agents included levofloxacin, linezolid, doxycycline, and cephalexin.
  - End-of-treatment success, 90%, is comparable to previous studies.
- Differences
  - Antimicrobials requiring central nervous system (CNS) penetration were more commonly required due to high incidence of epidural abscess, 56%.
  - Patients with retained or newly placed hardware were administered long term suppressive antimicrobial therapy.

CONCLUSIONS

- Since *Staphylococcus aureus* is the most common pathogen, our data supports guideline recommendations for empiric treatment with vancomycin.
- Guidelines do not address the need to treat vertebral osteomyelitis with regards to CNS penetration. Concurrent epidural abscess was common, 56%, and until imaging has resulted, we utilize intravenous agents with adequate CNS penetration.
  - Daptomycin and cefazolin, for example, and oral agents should only be used as alternative therapy when epidural abscess has been ruled out.
- Vertebral osteomyelitis is an increasing infectious complication among our IVDU patients. We routinely assess all *Staphylococcus aureus* bacteremia patients for back pain, and requesting spinal imaging if present.
- Understanding long-term clinical outcomes is a challenge in a patient population with a high incidence of substance abuse. At 12-months, 27% all-cause mortality may still be underestimating potential clinical failures.
  - Opportunities to optimize treatment are still needed.

REFERENCES

1. Mandell G. *Principles and Practice in Infectious Diseases*.7th ed. Philadelphia: Churchill Livingstone, 2009 Print.
2. Lew D, et al. Osteomyelitis. Lancet 2004;364:369-79
3. Berbari, et al. 2015 IDSA Clinical Practice Guidelines for the Diagnosis and Treatment of Native Vertebral Osteomyelitis.in Adults. CID 2015 doi: 10.1093/cid/civ482
4. McHenry MC, et al. Vertebral osteomyelitis long term outcome for 253 patients in 7 Cleveland-area hospitals. CID 2002:34:1342-50

Presented at ID Week, New Orleans, LA, October 26-30, 2016