CLINICAL VIGNETTE

An Unusual Cause of Neck Pain: Cervical Osteomyelitis

Sarah C. Kim, MD

Clinical Case

A 49-year-old man presents complaining of neck pain. He reports "tweaking" his neck 3 weeks prior. He was watching the Super Bowl on television and turned his neck abruptly, and he felt pain immediately. The pain is localized to the right posterior neck and radiates into right upper back. He denies any numbness or weakness. He tried taking ibuprofen which did not alleviate his pain. He obtained a massage which significantly worsened his pain. Acupuncture helped slightly. He reports muscle spasms in his posterior neck and upper back which progressively worsened over the next week prompting evaluation in urgent care. He was diagnosed with muscle strain and given cyclobenzaprine 10-20 mg qhs. A few days after starting the muscle relaxant, he started having profuse, drenching night sweats, to the point that he needed to change his shirt five times. He first checked his temperature two days ago and noted a fever of 101°F. He denies any sweating during the day, any chest pain, shortness of breath, palpitations, nausea, vomiting, diarrhea, abdominal pain, cough, sore throat, rhinorrhea or urinary symptoms. There has been no recent travel. His partner had flu-like symptoms a few weeks ago, but no other sick contacts. His neck pain has persisted despite taking ibuprofen or cyclobenzaprine. His energy level is still good but he is unable to work due to his neck pain. There is no significant past medical or family history and no chronic medications. He works in advertising and enjoys hiking and running regularly. He has never smoked cigarettes or used recreational drugs. He drinks a glass of wine weekly and smokes marijuana occasionally.

The patient's exam revealed slightly elevated blood pressure at 147/90, pulse 86, temperature 36.6° C and oxygen saturation was 95% on room air. He appeared comfortable without any acute distress. HEENT was remarkable only for mild cervical lymphadenopathy without discrete neck masses. CV, pulmonary and abdominal exams were normal. There was mild tenderness to palpation over cervical paraspinal muscles, with intact cranial nerves and sensation.

Laboratory evaluation included normal metabolic panel, normal complete blood count, normal urinalysis, and normal thyroid tests. His erythrocyte sedimentation rate was elevated at 52 and his C-reactive protein was significantly elevated at 12.3. His ferritin level was also elevated at 640. A swab for influenza A/B was negative. His blood test for infectious monospot antibody was positive. His chest x-ray was unremarkable.

Patient's clinical presentation included subacute neck pain with mild cervical lymphadenopathy and fever of unknown origin. Although unusual in presentation, the possibility of infectious mononucleosis was considered and patient was counseled on supportive care measures. However, over the next couple of weeks, his condition deteriorated. He reported having new onset numbness in his upper body involving his chest and bilateral upper extremities. He denied any weakness or bowel/bladder incontinence. He was instructed to go to the Emergency Room where an MRI Cervical Spine showed cervical osteomyelitis, discitis, a ventral epidural abscess at C2-C4 and an epidural phlegmon at C2-C7 with severe canal stenosis and mild cord compression. He was admitted to the Neurosurgery service and underwent C3-4 corpectomy and C2-5 anterior and posterior fusion. Infectious Diseases recommended broad-spectrum antibiotic coverage. Cervical spinal cultures grew MSSA and patient was switched to Oxacillin. His blood cultures remained negative. He was treated with a 6-week course of parenteral oxacillin, followed by oral doxycycline which he took for a year. Echocardiogram was done which showed no valvular disease or vegetations. Patient completed an extensive course of physical therapy and was able to make a full recovery aside from mild residual numbness in his hands.

Discussion

The incidence of vertebral osteomyelitis increases with age and most often occurs in patients over 50. Men are affected twice as often as women. The most common risk factors for vertebral osteomyelitis include injection drug use, infective endocarditis, degenerative spine disease, prior spinal surgery, diabetes mellitus, corticosteroid therapy or other immunocompromised state.[1]

Vertebral osteomyelitis most commonly results from hematogenous seeding of one or more vertebral bodies from a distant focus. Potential sources of hematogenous spread include the genitourinary tract, respiratory tract, infected intravascular devices, infective endocarditis and dental infection. Often the primary site of infection cannot be identified. Adult vertebral bone contains highly vascular marrow with sluggish but high-volume blood flow. When bacteria transit the vertebral marrow, they can produce a spontaneous local suppurative infection, which may be further facilitated by prior bone trauma or alterations to normal bone architecture. Vertebral arteries bifurcate to supply blood to two adjacent end plates of the vertebrae. For this reason, hematogenous vertebral osteomyelitis often

causes bone destruction in two adjacent vertebral bodies and usually destroys their intervertebral disc. The second route of infection includes contiguous spread from tissues adjacent to the spine such as the bowel, aorta or esophagus. The third route of infection includes extension of infection as a result of direct inoculation from trauma or invasive spinal procedures. This type of infection usually results in epidural abscess, subdural abscess or meningitis. The most common cause of vertebral osteomyelitis is Staphylococcus aureus with an increase in methicillin resistant S. aureus. Less common causes of vertebral osteomyelitis include enteric gram-negative bacilli usually following urinary tract infection, streptococci, pseudomonas aeruginosa and Candida.[2,3]

Patients with vertebral osteomyelitis present with pain which is usually localized to the infected disc space and exacerbated by physical activity. Spinal pain usually begins insidiously and progressively worsens over several weeks to months. The pain is often accompanied by muscle spasms. One study found the mean duration of symptoms was 48 +/- 40 days prior to diagnosis. The pain is often worse at night. Fever seems to be an inconsistent symptom present in about half of patients with vertebral osteomyelitis.[4] Back pain due to vertebral osteomyelitis may respond initially to conservative treatment, thereby leading to erroneous diagnoses of muscle strain or other noninfectious causes. Physical examination can show local tenderness to spinal percussion. Laboratory evaluation can sometimes show an elevated leukocyte count but is often normal. Elevations in the erythrocyte sedimentation rate and C-reactive protein are found in more than 80 percent of patients, as was the case with our patient.[5] Unfortunately, the monospot antibody being positive was a red herring and further delayed his diagnosis.

The diagnosis of vertebral osteomyelitis is made based on positive culture obtained from image guided biopsy.[6] It can also be inferred if clinical and radiographic findings are consistent with vertebral osteomyelitis with positive blood cultures. MRI is the most sensitive imaging for diagnosis of vertebral osteomyelitis and epidural abscess.[2] Management of vertebral osteomyelitis consists of antimicrobial therapy and percutaneous drainage of paravertebral abscess if present. Most studies recommend a minimum 6 week course of parenteral antimicrobial therapy, however some studies have shown a 2 week course of parenteral therapy followed by oral antimicrobial therapy is sufficient in certain patients who have no significant complications and comorbidities if a suitable drug is available with excellent bioavailability.[7,8] Surgical evaluation is warranted for patients with neurologic deficits, radiographic evidence of epidural or paravertebral abscess and/or cord compression, as in our patient. Patients are monitored closely throughout treatment with weekly labs including ESR and CRP.[9] Routine follow up imaging is not necessary, as some imaging studies appear to worsen during initial therapy but ultimately result in successful treatment. Follow-up imaging studies are warranted in patients whose clinical picture does not improve in the expected time frame, to evaluate for presence of an abscess that may need drainage.[2,10]

Conclusion

The cause of our patient's vertebral osteomyelitis was unclear. There was no evidence of cardiac disease, no history of recent medical or dental procedures, no history of intravenous drug use and no history of skin infection such as boils or folliculitis. The working hypothesis is that his repeated acupuncture procedures in the neck area could have theoretically been the source of bacterial seeding but this remains unclear.

REFERENCES

1. **Sapico FL, Montgomerie JZ**. Pyogenic vertebral osteomyelitis: report of nine cases and review of the literature. *Rev Infect Dis*. 1979 Sep-Oct;1(5):754-76. doi: 10.1093/clinids/1.5.754. PMID: 542761.
2. **Berbari EF, Kanj SS, Kowalski TJ, Darouiche RO, Widmer AF, Schmitt SK, Hendershot EF, Holtom PD, Huddleston PM 3rd, Petermann GW, Osmon DR, Infectious Diseases Society of America**. 2015 Infectious Diseases Society of America (IDSA) Clinical Practice Guidelines for the Diagnosis and Treatment of Native Vertebral Osteomyelitis in Adults. *Clin Infect Dis*. 2015 Sep 15;61(6):e26-46. doi: 10.1093/cid/civ482. Epub 2015 Jul 29. PMID: 26229122.
3. **Kulowski J**. Pyogenic osteomyelitis of the spine: an analysis and discussion of 102 case. *The Journal of Bone & Joint Surgery*. 1936 Apr;18(2):343-64.
4. **Nolla JM, Ariza J, Gómez-Vaquero C, Fiter J, Bermejo J, Valverde J, Escofet DR, Gudiol F**. Spontaneous pyogenic vertebral osteomyelitis in nondrug users. *Semin Arthritis Rheum.* 2002 Feb;31(4):271-8. doi: 10.1053/sarh.2002.29492. PMID: 11836660.
5. **Beronius M, Bergman B, Andersson R**. Vertebral osteomyelitis in Göteborg, Sweden: a retrospective study of patients during 1990-95. *Scand J Infect Dis*. 2001;33(7):527-32. doi: 10.1080/00365540110026566. PMID: 11515764.
6. **Diffre C, Jousset C, Roux AL, Duran C, Noussair L, Rottman M, Carlier RY, Dinh A**. Predictive factors for positive disco-vertebral biopsy culture in pyogenic vertebral osteomyelitis, and impact of fluoroscopic versus scanographic guidance. *BMC Infect Dis*. 2020 Jul 16;20(1):512. doi: 10.1186/s12879-020-05223-z. PMID: 32677896; PMCID: PMC7364507.
7. **Park KH, Cho OH, Lee JH, Park JS, Ryu KN, Park SY, Lee YM, Chong YP, Kim SH, Lee SO, Choi SH, Bae IG, Kim YS, Woo JH, Lee MS**. Optimal Duration of Antibiotic Therapy in Patients With Hematogenous Vertebral Osteomyelitis at Low Risk and High Risk of Recurrence. *Clin Infect Dis*. 2016 May 15;62(10):1262-1269. doi: 10.1093/cid/ciw098. Epub 2016 Feb 24. PMID: 26917813.
8. **Li HK, Rombach I, Zambellas R, Walker AS, McNally MA, Atkins BL, Lipsky BA, Hughes HC, Bose D, Kümin M, Scarborough C, Matthews PC, Brent AJ, Lomas J, Gundle R, Rogers M, Taylor A, Angus B, Byren I, Berendt AR, Warren S, Fitzgerald FE, Mack**

DJF, Hopkins S, Folb J, Reynolds HE, Moore E, Marshall J, Jenkins N, Moran CE, Woodhouse AF, Stafford S, Seaton RA, Vallance C, Hemsley CJ, Bisnauthsing K, Sandoe JAT, Aggarwal I, Ellis SC, Bunn DJ, Sutherland RK, Barlow G, Cooper C, Geue C, McMeekin N, Briggs AH, Sendi P, Khatamzas E, Wangrangsimakul T, Wong THN, Barrett LK, Alvand A, Old CF, Bostock J, Paul J, Cooke G, Thwaites GE, Bejon P, Scarborough M; OVIVA Trial Collaborators. Oral versus Intravenous Antibiotics for Bone and Joint Infection. *N Engl J Med*. 2019 Jan 31;380(5):425-436. doi: 10.1056/NEJMoa1710926. PMID: 30699315; PMCID: PMC6522347.

9. **Khan MH, Smith PN, Rao N, Donaldson WF**. Serum C-reactive protein levels correlate with clinical response in patients treated with antibiotics for wound infections after spinal surgery. *Spine J*. 2006 May-Jun;6(3):311-5. doi: 10.1016/j.spinee.2005.07.006. PMID: 16651226.
10. **Carragee EJ**. The clinical use of magnetic resonance imaging in pyogenic vertebral osteomyelitis. *Spine (Phila Pa 1976)*. 1997 Apr 1;22(7):780-5. doi: 10.1097/00007632-199704010-00015. PMID: 9106320.