

6-2-2019

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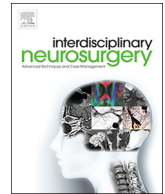
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Recommended Citation

Agarwal, AB, Prateek; Agarwal, MD, Nitin; Hansberry, MD, PhD, David; Majmundar, MD, Neil; and Goldstein, MD, Ira M., "Sternoclavicular joint arthropathy mimicking radiculopathy in a patient with concurrent C4-5 disc herniation" (2019). *Department of Radiology Faculty Papers*. Paper 62.

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Technical Notes & Surgical Techniques

Sternoclavicular joint arthropathy mimicking radiculopathy in a patient with concurrent C4-5 disc herniation



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ARTICLE INFO

Keywords:

Herniated nucleus pulposus

Anterior cervical discectomy

Sternoclavicular joint arthropathy

ABSTRACT

Background: Patients with sternoclavicular joint arthropathy, which can result from septic arthritis, often present with localized sternoclavicular pain as well as shoulder pain. Such pain may be similar to the presenting symptoms of cervical intervertebral disc herniation.

Clinical presentation: A 47-year-old female presented with 1 month of significant pain in the neck as well as right anterior chest and deltoid. The patient was found to have reduced strength in the right deltoid muscle on physical examination. MRI revealed a C4-C5 herniated nucleus pulposus. The patient underwent successful C4-C5 anterior cervical discectomy, but subsequently developed painful swelling in the region of the right sternoclavicular joint with limited motor strength in the right shoulder and arm. A needle biopsy of the mass yielded negative results, but her erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) numbers did respond to antibiotics, consistent with infection of the sternoclavicular joint. A follow-up CT scan (6.5 months postoperatively) revealed apparent resolution right sternoclavicular joint arthropathy, though the patient continued to experience pain. 15 months postoperatively, the patient was prescribed methotrexate due to persistent pain and mild weakness arising from a possible rheumatologic inflammation. 19 months postoperatively, the patient had full strength of the right shoulder and arm and visible decrease in swelling at the sternoclavicular joint. More than three years postoperatively, the patient was diagnosed with multiple myeloma, which was appropriately treated. At follow-up four years postoperatively, the patient had an MRI showing new C6-C7 herniated nucleus pulposus, but no longer had any right shoulder or chest pain or associated weakness.

Conclusion: This case demonstrates that sternoclavicular joint arthropathy results in symptoms that can mimic the presenting symptoms of shoulder or cervical spine pathology, such as shoulder and neck pain, necessitating careful diagnosis and management.

1. Introduction

Septic arthritis, or joint inflammation that results from infection, is an important cause of joint arthropathy and can have significant morbidity and mortality if not diagnosed and treated quickly. Septic arthritis is relatively rare, with an estimated incidence of 4–10 per 100,000 patient-years in Western Europe [1]. Traditionally, diagnosis of septic arthritis relies on one of four criteria to be met, namely isolation of a pathogenic organism from affected joint, isolation of pathogenic organism from blood, typical clinical features, or postmortem or pathological features suspicious of septic arthritis [2].

With specific regards to septic arthritis of the sternoclavicular joint, most patients present with chest pain that is localized to the sternoclavicular joint area. Patients also frequently present with shoulder pain, while neck pain and painless swelling over the sternoclavicular joint are less common symptoms. The most prevalent risk factor for sternoclavicular septic arthritis is intravenous drug use (IDU), and the bacterial pathogen *Staphylococcus aureus* accounts for approximately 50% of all cases [3].

These presenting symptoms of sternoclavicular joint arthropathy, either from infection or other etiologies, are extremely similar to symptoms seen with cervical spine pathology, most notably shoulder

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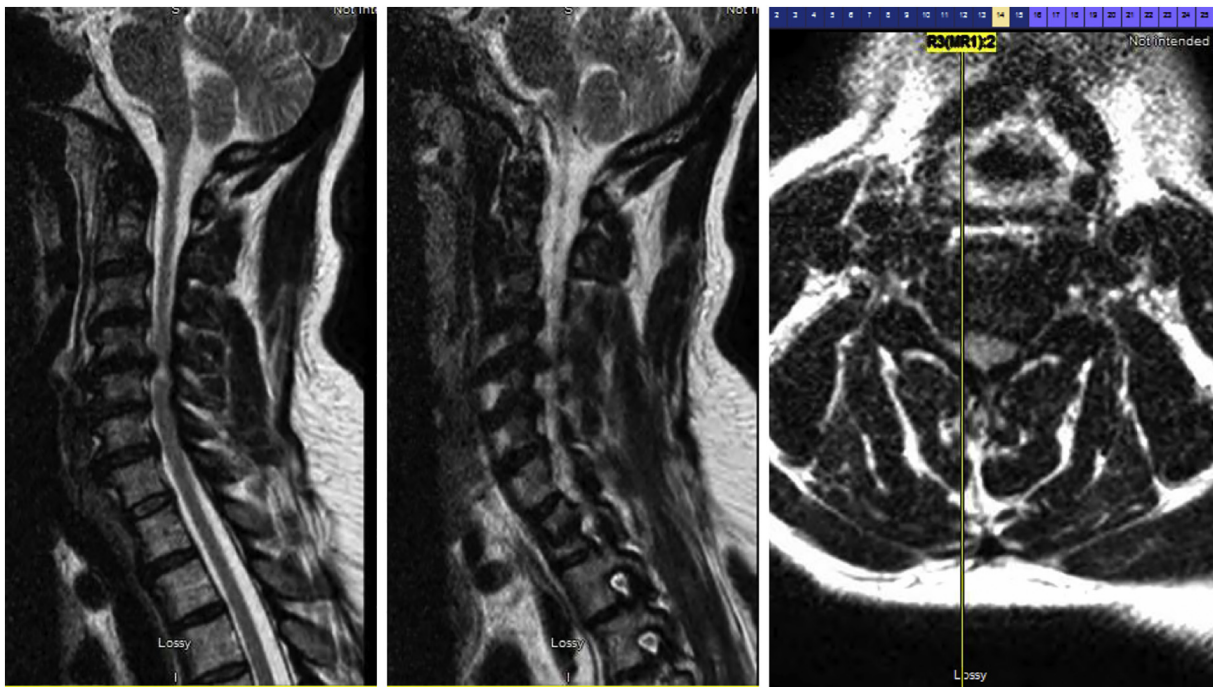


Fig. 1. Cervical spine MRI at presentation demonstrating C4-C5 herniated nucleus pulposus.

pain and neck pain. Thus, it is imperative that such presenting symptoms are not incorrectly attributed to cervical spine pathology, especially when they persist following successful anterior cervical discectomy to resolve herniated nucleus pulposus. In this case report, we present a patient who underwent C4-C5 anterior cervical discectomy and fusion (ACDF) with subsequent presentation of presumed right sternoclavicular septic arthritis.

2. Clinical presentation

A 47-year-old female with no history of intravenous drug use, past surgeries, or immunodeficiency presented with 1-month significant pain in the neck as well as right anterior chest and deltoid. She noted previously being diagnosed at an outside hospital with pleurisy and arthritis of the right shoulder after experiencing the onset of her pain with a negative cardiac workup several weeks earlier. On physical examination, she had tenderness to palpation of the right pectoralis muscle, right deltoid, and right anterior chest as well as 4/5 strength in the right deltoid. MRI of the cervical spine revealed a C4-C5 herniated nucleus pulposus (Fig. 1). Given the absence of shoulder pathology and her right-sided C4-C5 disc herniation, the patient's symptoms reasonably appeared to be linked to her neck. The patient underwent C4-C5 ACDF without any intraoperative complications. Following the procedure, the patient entered postoperative rehabilitation. Two weeks postoperatively, she began to experience pain and swelling in the area of the right sternoclavicular joint.

2.1. Postoperatively

After the patient began to experience pain and swelling in the area of the right sternoclavicular joint, she was ultimately referred to infectious disease and prescribed a course of intravenous daptomycin. Importantly, a CT scan showed an erosion in the area of the right sternoclavicular joint (Fig. 2) and a SPECT study showed increased radionuclide uptake in that area (Fig. 3). Blood workup indicated a normal white blood cell (WBC) count (9.1), but an elevated erythrocyte sedimentation rate (ESR) (117) and C-reactive protein (CRP) level (155). She demonstrated improvement on antibiotics, but a physical

examination 1 month postoperatively revealed a large and firm mass in the sternoclavicular area with discomfort with range of motion of the right shoulder. Aside from slight weakness in the right deltoid, biceps, and triceps (4+/5) 1.5 months postoperatively, her motor strength was otherwise normal and her wound site from the C4-C5 discectomy had healed well with no palpable lymphadenopathy or neck swelling. Together, these results suggested that the patient suffered from infection of the right sternoclavicular joint.

Curiously, a biopsy of the sternoclavicular joint mass 1 month postoperatively had yielded a negative result for all cultures, prompting repeat blood tests while the patient was given a second course of daptomycin that was completed 2 months postoperatively. At this time, her WBC count (5.7) and CRP (2.9) were markedly reduced. At 3.5 months postoperatively, the patient's laboratory values were as follows: WBC 6.7, ESR 43, CRP 3.2. 4.5 months postoperatively, the patient's WBC count (6.1), ESR (23), and CRP (3.0) were all within normal range. She continued to have significant pain in the right shoulder (motor strength remained 4+/5 in deltoid and biceps), chest, and locally around the sternoclavicular joint, but swelling of the sternoclavicular joint had decreased in volume. Flexion and extension x-rays of the cervical spine 4 months postoperatively demonstrated a solid fusion had been attained at the ACDF site without evidence of local swelling or bony erosion (Fig. 4). 6 months postoperatively, CT scan of the sternoclavicular joint showed erosive changes similar to the first CT scan (Fig. 5), while MRI of the right shoulder showed mild degenerative changes of the acromioclavicular joint, narrowing of the supraspinatus outlet, and degenerative tear of the superior labrum. Given that the patient's ESR and CRP seemed to respond to the second course of daptomycin, the presumptive diagnosis remained infection of the sternoclavicular joint and/or adjacent bone.

A CT scan 6.5 months postoperatively showed apparent resolution of right sternoclavicular septic arthritis with sclerotic margins about the joint, minimal erosion, and no displacement. The palpable lump over the right sternoclavicular joint was much smaller than before, and there was less pain with motion of the right shoulder. A repeat SPECT study 10 months postoperatively showed decreased radionuclide uptake at the right sternoclavicular joint compared with prior (Fig. 6). Despite the prescription of Lidoderm patch and continued physical therapy,

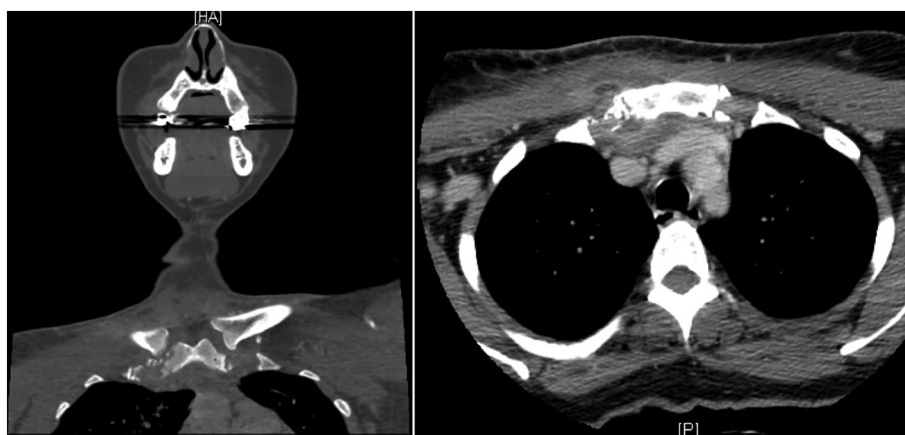


Fig. 2. Postoperative neck CT scan demonstrating erosion in area of right sternoclavicular joint.

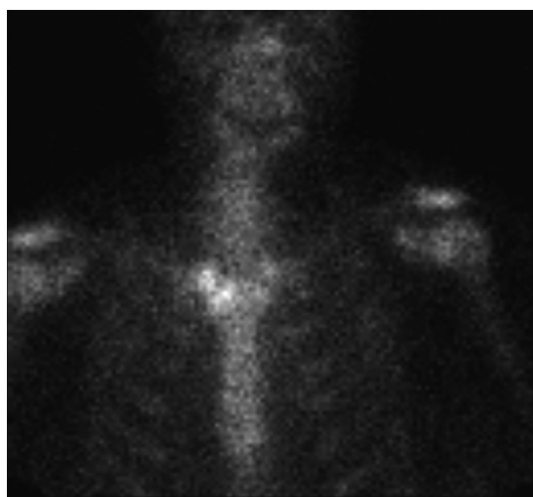


Fig. 3. Postoperative SPECT study demonstrating increased radionuclide uptake in area of right sternoclavicular joint.

12 months postoperatively, the patient still had fairly significant pain in the right sternoclavicular joint to motion of the right arm and direct palpitation. As for her neck, it remained soft and supple with no

swelling or palpable masses. Approximately 15 months postoperatively, repeat x-rays of the cervical spine with flexion and extension views demonstrated a solid fusion (Fig. 7). Nevertheless, the patient still suffered from intermittent pain at the anterior base of her neck that radiated into the right shoulder and deltoid, decreased motor strength of 4+/5 in deltoid, and poor range of motion of the right shoulder.

Due to her persistent pain, the patient was referred to a rheumatologist to investigate potential causes of her presenting symptoms other than septic arthritis. She was prescribed methotrexate to treat potential rheumatologic inflammation because of an ESR that had become elevated again and newfound elevated creatine phosphokinase (CPK) levels. At follow-up 19 months postoperatively, the patient noted that she had gastric reflux for a couple months as well as mild dysphagia with certain solid foods, but stated that she was steadily improving. Her motor strength of the right shoulder and arm was rated 5/5 throughout, and the mass above the sternoclavicular joint was visibly smaller. Yet, she continued to pain in the right sternoclavicular joint region with radiation to the shoulder. The patient was prescribed gabapentin, naproxen, cyclobenzaprine, and diclofenac gel and instructed to continue physical therapy. More than three years postoperatively, the patient was diagnosed with multiple myeloma, which was appropriately treated with dexamethasone, chemotherapy, and two bone marrow transplants. At follow-up four years postoperatively, the patient had an MRI showing new C6-C7 herniated nucleus pulposus

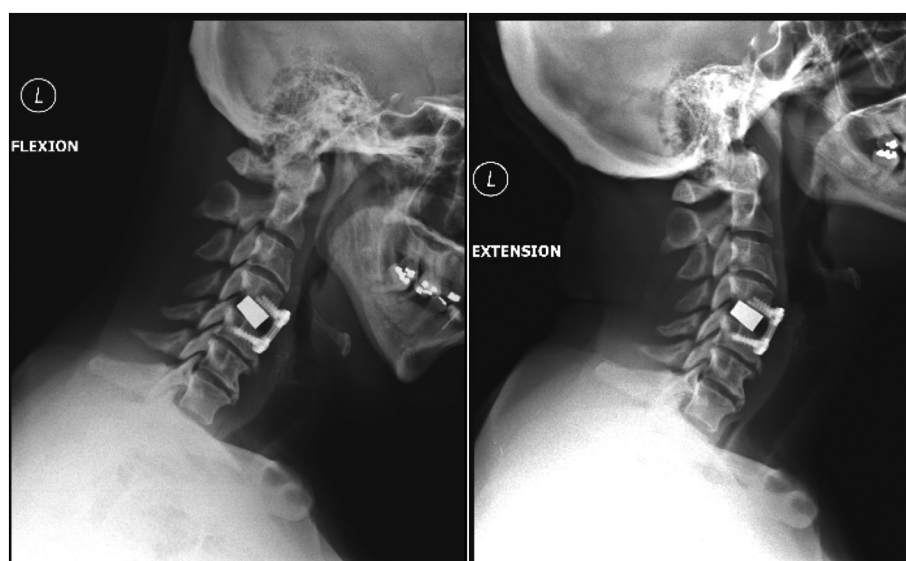


Fig. 4. Flexion and extension cervical spine x-rays 4 months postoperatively demonstrating solid bony fusion at C4-C5 ACDF site.

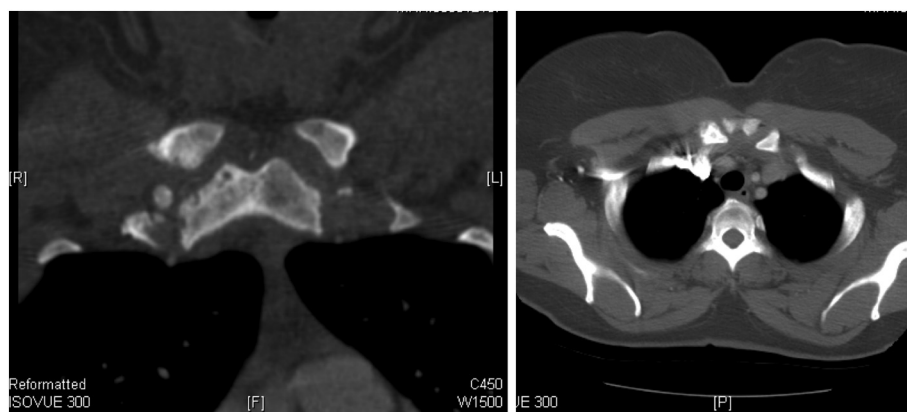


Fig. 5. Neck CT scan 6 months postoperatively demonstrating erosive changes similar to immediate postoperative neck CT scan.

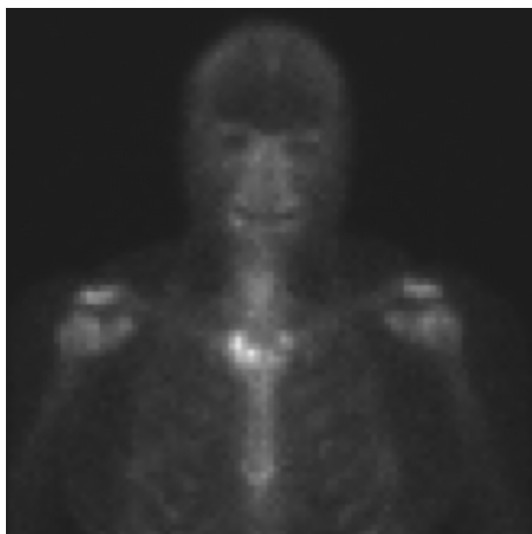


Fig. 6. SPECT study 10 months postoperatively demonstrating decreased radionuclide uptake at the right sternoclavicular joint compared with immediate postoperative SPECT study.



Fig. 8. Cervical spine MRI 4 years postoperatively demonstrating new C6-C7 herniated nucleus pulposus.

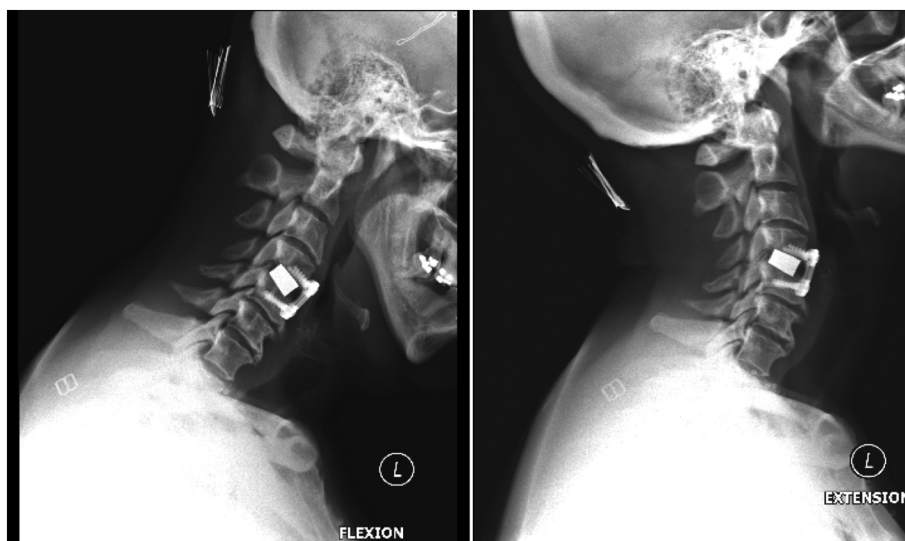


Fig. 7. Flexion and extension cervical spine x-rays 15 months postoperatively demonstrating continued solid bony fusion at C4-C5 ACDF site.

(Fig. 8), but no longer had any right shoulder or chest pain, swelling, or associated weakness.

3. Discussion

3.1. Septic arthritis: risk factors, diagnosis, treatment

In the present case, septic arthritis or infection of the right sternoclavicular joint complicated by possible osteomyelitis was the presumptive diagnosis. The most recent review of 180 cases of septic arthritis of the sternoclavicular joint lists several predisposing conditions including intravenous drug use, infection at a distant site, diabetes mellitus, trauma, and infected central venous access [3]. However, this patient had none of these risk factors, indicating that septic arthritis of the sternoclavicular joint can present without traditional risk factors [4–6]. While septic arthritis of the sternoclavicular joint can present in otherwise healthy individuals, the phenomenon is rare, as a recent review found only 27 such documented cases [7]. There is also evidence of a predominance of septic arthritis of the right sternoclavicular joint in non-IDU patients, which is consistent with this case [3].

Rare instances of septic arthritis of the sternoclavicular joint have been reported following traditional head and neck surgery [8]. Although no cases have been reported following anterior spine surgery, it is reasonable to suspect that sternoclavicular joint infection could mimic pathology of other structures in the cervical region such as the esophagus [9]. Interestingly, pneumococcal septic arthritis has occasionally been found to be the initial presentation of multiple myeloma [10,11]. However, the present patient was diagnosed with multiple myeloma more than three years postoperatively.

3.2. Septic arthritis: diagnosis

When needle aspirate is performed to definitively diagnose septic arthritis of the sternoclavicular joint, as was done in this patient, cultures have been positive in 77% of patients [3]. Thus, an inability to discover a causative organism does not rule out the diagnosis of septic arthritis. Blood cultures can also increase the chance of obtaining a causative organism, as one study of septic arthritis reported 24% of cases with positive blood cultures. This study also reported identification of the causative organism in 67% of cases with cultured synovial joint fluid, although joint aspiration is often not feasible [12].

When a causative organism is definitively identified from a needle biopsy or synovial joint fluid, it is simple to diagnosis septic arthritis. Lack of a causative organism does make the diagnosis of septic arthritis less likely, necessitating collaboration with a rheumatologist, which was done in this case [13]. An interesting study compared patients with bacteria isolated from synovial fluid to patients with suspected infection, in which bacteria was not isolated from culture. The study found that the two groups of patients risk factors, presenting symptoms, laboratory investigation results, additional supportive treatment, and short-term and long-term mortality did not differ significantly [14].

Although the ESR and CRP are valuable to measure, there have been reported instances where these numbers are normal at presentation of septic arthritis [15]. Furthermore, these measurements may not distinguish septic arthritis from other forms of acute arthritis (e.g. rheumatologic) [16], which may warrant measurement of procalcitonin in the serum for accurate differentiation [17]. Still, there was reasonable confidence to suspect septic arthritis in this case since the patient's ESR/CRP values and presenting symptoms appeared to directly respond to antibiotic treatment.

3.3. Septic arthritis: treatment

It is important to note that in cases of septic arthritis where a causative organism is not yet determined, an antibiotic with bactericidal activity against *S. aureus* and streptococci should be used, as these are

probable pathogens in all risk groups [18,19]. In this case, needle biopsy yielded negative results for all cultures, prompting the use of daptomycin, an antibiotic that is bactericidal against Gram-positive bacteria and has proven activity against the two aforementioned pathogens. One should consider the optimal duration of antibiotic as well, but there is a lack of evidence with regards to this. In particular, a large meta-analysis of antibiotic treatment for septic arthritis did not show any therapeutic regimen to be preferential to another [20]. Daptomycin is an antibiotic from a relatively new class of antimicrobials in an attempt to overcome resistance to glycopeptides. It is a lipopeptide antibiotic that has proven efficacy in complicated skin and soft tissue infections and has been shown to cure bone and/or joint infection in 81% of cases where administered [7,21].

Surgical osteotomy was considered as a last resort in this patient. While surgery was performed in 58% of patients in a study of 180 cases of sternoclavicular septic arthritis [3], such a treatment is invasive and unnecessary if the presenting symptoms can be managed with antibiotics and physical therapy. Early diagnosis is critical for the success of conservative management, particularly because of the complications that are often associated with septic arthritis of the sternoclavicular joint. These include osteomyelitis [22], abscess formation [23,24], mediastinitis [25], and empyema [26]. In this case, surgical osteotomy was not performed, and the patient ultimately had improved appearance of the sternoclavicular joint on imaging and complete resolution of her symptoms.

3.4. Other etiologies of sternoclavicular joint arthropathy

Sternoclavicular joint arthropathy may occur as a result of infection (i.e. septic arthritis) but may also arise from malignancy or hypertrophy of the joint itself. Malignancy was not observed in this patient from the tissue sample obtained during needle biopsy. Nevertheless, there have been reported cases of sternoclavicular joint swelling after head and neck surgery perhaps related to standard shoulder roll extension in patients with preexisting arthritis [27]. Others have proposed the notion of a pseudo-tumor, in which sternoclavicular joint hypertrophy occurs due to muscular imbalance and instability following radical neck dissection [28,29]. One must consider these other etiologies of sternoclavicular joint arthropathy in the present patient especially given negative culture results, but the constellation of laboratory/imaging findings and their response to antibiotics is more suggestive of septic arthritis as an etiology.

4. Conclusion

We have presented a case of a C4-C5 herniated nucleus pulposus with right shoulder, right anterior chest, and neck pain and presumed concurrent septic arthritis of the right sternoclavicular joint. This case is particularly informative because of the sternoclavicular joint arthropathy symptoms that mimicked the presenting symptoms of shoulder or cervical spine pathology. In this case, there was not only solid fusion of the cervical vertebrae with no neck swelling or palpable masses following anterior cervical discectomy, but there was also an absence of significant shoulder pathology. Consequently, the patient's post-operative presenting symptoms were linked to the sternoclavicular joint, rather than the shoulder or cervical spine. Prior to operation, the patient's presenting symptoms appeared reasonably related to her C4-C5 herniated nucleus pulposus, but post-operative care indicates that sternoclavicular joint arthropathy would have been more accurate etiology at the time. In this specific case, swelling of the right sternoclavicular joint was not evident before the operation, but caution is warranted before attributing shoulder and neck pain to cervical spine pathology.

Funding statement

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Contributorship statement

All authors were involved in the design and conception of this manuscript. PA, NA, and DRH performed the literature search and compiled the primary manuscript. IMG compiled the figures and critically revised the manuscript. All authors have approved the manuscript as it is written.

Declaration of Competing Interest

The authors have no personal or institutional interest with regards to the authorship and/or publication of this manuscript.

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