Primary Osteomyelitis of the Clavicle in Children

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abstract

Osteomyelitis of the clavicle is a rare entity with a broad differential diagnosis and high potential for complications if not diagnosed promptly and treated appropriately. The threshold for surgical intervention should be low to prevent osteonecrosis and bony resorption. In addition, although rare, life-threatening complications have been reported. This report describes primary osteomyelitis of the clavicle that was diagnosed in a 22-month-old girl on her third clinical evaluation after 4 days of symptoms. She presented to a children’s tertiary care emergency department with fever and acute pain and swelling of her right shoulder and arm. The diagnosis was confirmed through clinical, laboratory, and imaging studies including ultrasound; these revealed subperiosteal abscess formation, which may have developed in part as the result of a delayed diagnosis from the 2 prior emergency department visits. The patient was treated initially with intravenous antibiotics and underwent therapeutic as well as diagnostic needle-guided tissue aspiration under ultrasound guidance. This ruled out malignancy but was not curative, and the subperiosteal abscess recurred within 24 hours, prompting formal operative irrigation and debridement. The patient was seen for 12-month follow-up and has had no complications or evidence of recurrence. This case emphasizes the need for a high index of suspicion to prevent diagnostic delays as well as the importance of a low threshold for surgical debridement to minimize the potential for complications that could prolong the treatment course. [Orthopedics. 2016; 39(4):e760-e763.]

Primary osteomyelitis of the clavicle is rare, being reported in approximately 2% to 7% of all patients with osteomyelitis. In the pediatric age group, osteomyelitis of the clavicle usually is spread hematogenously secondary to an infection elsewhere in the body. The diagnosis may be difficult, and a high index of suspicion is mandatory. Predisposing factors include subclavian venipuncture, immunocompromise, and irradiation and surgical treatment for head and neck lesions. Clavicle reosorption may occur with late diagnosis, and osteonecrosis can result from poor medullary blood supply. This case report of osteomyelitis of the clavicle in a 22-month-old girl emphasizes the importance of a high index of suspicion, early diagnosis, and low threshold for surgical intervention in children with suspected clavicular osteomyelitis.

CASE REPORT

A 22-month-old otherwise healthy girl presented to an outside facility with right arm pain and decreased shoulder and arm motion, high-grade intermittent fever (104°F), and lethargy. She initially was diagnosed with acute viral illness and was discharged. She re-presented for evaluation of the right shoulder 4 days later with fever and acute onset of pain, swelling, and decreased arm motion. She was subsequently transferred to our institution for evaluation. The patient was afebrile at presentation, and physical examination revealed decreased arm motion at the shoulder and elbow, as well as active and passive motion with decreased range of motion at the affected shoulder. Laboratory testing was unremarkable. Imaging studies included plain radiographs, ultrasound, and computed tomography (CT) of the shoulder, which revealed subperiosteal abscess formation, which may have developed in part as the result of a delayed diagnosis from the 2 prior emergency department visits. The patient was treated initially with intravenous antibiotics and underwent therapeutic as well as diagnostic needle-guided tissue aspiration under ultrasound guidance. This ruled out malignancy but was not curative, and the subperiosteal abscess recurred within 24 hours, prompting formal operative irrigation and debridement. The patient was seen for 12-month follow-up and has had no complications or evidence of recurrence. This case emphasizes the need for a high index of suspicion to prevent diagnostic delays as well as the importance of a low threshold for surgical debridement to minimize the potential for complications that could prolong the treatment course. [Orthopedics. 2016; 39(4):e760-e763.]

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sent home. During the following 48 hours, the high fever persisted, and the girl developed supraclavicular soft tissue swelling, erythema, and induration. She returned to the same facility and again was sent home directly from the emergency department. No laboratory or imaging studies were performed during either visit.

Three days after onset, the girl was brought to the current authors’ emergency department. Physical examination showed a 6×3-cm area of induration and tenderness with soft tissue swelling and erythema overlying the right anterior chest wall, supraclavicular region, and upper abdomen. Aside from subtle soft tissue widening, plain anteroposterior radiographs appeared unremarkable on presentation (Figure 1). Diagnostic upper chest ultrasound revealed a large palpable fluid collection around the right medial clavicular metaphysis (Figures 2).

Following laboratory studies and blood cultures, the girl was given an initial dose of intravenous clindamycin. Magnetic resonance imaging (MRI) of the shoulder and clavicle confirmed the inflammatory changes consistent with osteomyelitis and subperiosteal abscess (Figure 3). Antibiotics were withheld until biopsy could be obtained through therapeutic and diagnostic ultrasound-guided needle aspiration to confirm suspected infection vs malignancy prior to developing a plan for definitive operative management, if required by the patient’s subsequent clinical course. In light of cytology negative for neoplastic cells and fluid demonstrating many white blood cells and Gram-positive cocci, the girl then was restarted on empiric intravenous antibiotics and underwent close observation for response to percutaneous abscess decompression.

The following day, on hospital day 3, the girl was febrile. A follow-up ultrasound demonstrated subperiosteal pus that had reaccumulated rapidly overnight, and aggressive surgical irrigation and debridement therefore was performed the same day. Cloudy, bloody fluid was evident in the subperiosteal space, and intraoperative frozen biopsy confirmed no evidence of neoplasia. Cultures from the initial aspiration subsequently produced methicillin-sensitive \textit{Staphylococcus aureus}, and the patient’s antibiotics were tailored to the sensitivities.
The girl was discharged home after her C-reactive protein normalized (1.3 from 9.1). She underwent outpatient follow-up and was given oral cephalexin for 6 weeks postoperatively until her sedimentation rate returned to normal. Interval follow-up radiographs at 5 weeks (Figure 1C) and 5 months (Figure 1D) postoperatively showed a mild periosteal reaction with sclerosis of the medial two-thirds of the clavicle, which subsequently resolved. Final radiographs at 12 months postoperatively showed no signs of osteonecrosis, sclerosis, or bone resorption (Figure 1E).

**DISCUSSION**

The differential diagnosis of clavicular osteomyelitis is broad. Chronic recurrent multifocal osteomyelitis, congenital anomalies, pathologic fracture from arteriovenous malformation, benign neoplasms, systemic infantile cortical hyperostosis, and medial clavicular osteonecrosis (Friedrich disease) may all mimic clavicular osteomyelitis radiographically.\(^7,8\) Clavicular osteomyelitis must be differentiated from malignant lesions, which can resemble infection on both laboratory and radiographic findings. These include primarily Ewing sarcoma, osteogenic sarcoma, multiple myeloma, granulocytic sarcoma, metastatic clear cell carcinoma, and lymphoma.\(^7\)

As with osteomyelitis at other anatomic sites, radiographs may appear normal until late in the disease course, and MRI may assist in early diagnosis, if tolerated by the pediatric patient.\(^9\) After appropriate imaging, tissue biopsy is a critical diagnostic tool for obtaining a microbial diagnosis in acute clavicular osteomyelitis and for ruling out neoplasms. The most common organism isolated from children in all age groups is *S aureus*;\(^6,7\) fungal, tuberculous, and mixed bacterial infections also have been reported.\(^2,10\)

As in the current case, the subcutaneous location of the clavicle lends particular utility to ultrasound to identify any subperiosteal abscess, which may be aspirated with little technical difficulty to expedite appropriate antibiotic selection based on cultures and sensitivities. In addition, if performed with careful attention to local anatomy, needle aspiration for histologic examination can safely and accurately rule out malignancy of the clavicle before definitive operative treatment.\(^11,12\) Thorough aspiration of purulent...
material may potentially provide curative evacuation of infection; however, many authors recommend more aggressive operative therapy.

Infections of the clavicle deserve special attention due to complications arising from its unique anatomy. Because nutrient arteries enter at the bone’s midpoint and run laterally, resorption of osteomyelitic bone preferentially occurs medially, and pathologic fractures and osteolysis have been reported in association with this. The medial end of the clavicle also comprises the sternoclavicular joint, and intra-articular extension of clavicular osteomyelitis has been reported to result in mediastinitis with compression of the innominate vein.

Burns et al reported an additional grave complication wherein foci of infection in close proximity to subclavian vessels may cause life-threatening hemorrhage if not aggressively debrided early.

Hematogenous clavicular osteomyelitis has been successfully treated with antibiotics alone. However, in light of these serious potential complications, there is literature demonstrating good efficacy of surgical treatment if initiated early. Baratz et al reported rapid improvement with claviculectomy in 2 patients in moribund condition who had previously undergone inadequate superficial debridement.

Among 6 children treated surgically for acute pyogenic osteomyelitis, Rasool and Govender reported complete recovery in 4 and subsequent healing of sequestectomy for 2 cases that became chronic. Two cases that failed antibiotics and required clavicle resection after a protracted course led Morrey and Bianco to recommend surgical debridement or resection to prevent recurrence. Lowden and Walsh had good functional results in 3 of 5 children with acute staphylococcal osteomyelitis who underwent surgical drainage. Srivastava et al reported no functional deficit in their 10 patients undergoing total claviculectomy, which they recommended as the treatment of choice for pyogenic osteomyelitis.

Other authors have advocated for early surgical therapy, promoting aggressive operative debridement especially if there is not a rapid (48 to 72 hours) response to antibiotics. A surgical advantage of the clavicle’s anatomy is that a superficial subcutaneous location allows easy access for a straightforward operative approach.

**CONCLUSION**

Osteomyelitis of the clavicle is rare, and confusion with alternate diagnoses is common; however, the consequences of delayed diagnosis and treatment in many cases can be dire. In the current case, the patient experienced a large subperiosteal abscess that recurred within 24 hours of initial drainage, leading to prolongation of hospital stay to allow for more aggressive operative debridement. These events may have been avoided with more timely diagnosis on the patient’s initial emergency department visits elsewhere. Consequently, a high index of suspicion is advised for acute clavicular osteomyelitis in patients presenting with fever and pain, swelling, and erythema of the shoulder, and early antibiotics and a low threshold for surgery are advocated, particularly if the patient does not demonstrate rapid, sustained improvement.

**REFERENCES**