

Case Report

A Case of Medial Clavicle and Manubrium Osteomyelitis Following Methicillin-Resistant *Staphylococcus Aureus* Bacteremia

Viraj Shah^{1*} , Riddhi R Machchhar¹ , Prachi Patel² 

¹Internal Medicine, Ocean University Medical Center, Brick, New Jersey, USA

²RCSM Government Medical College, Kolhapur, Maharashtra, India

*Correspondence author: Viraj Shah, Internal Medicine, Ocean University Medical Center, Brick, New Jersey, USA; Email: viraj.shah.md@gmail.com

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Abstract

Staphylococcus aureus (*S. aureus*) is a well-known bacterium that can reside asymptomatically on the human body in places like skin and mucous membranes, including the nares and gastrointestinal tract. In healthy individuals, *S. aureus* is less likely to cause infection, but if it does, various illnesses and complications are possible, like cellulitis and bacteremia, which can progress to severe conditions like osteomyelitis, sepsis, and septic shock. In addition, *S. aureus* is highly susceptible to mutating and gaining resistance to antibiotic treatment. One such known resistant strand is Methicillin-Resistant *Staphylococcus Aureus* (MRSA). We present a case of an older diabetic male with a mediastinal abscess and subsequent diagnosis of osteomyelitis of his proximal clavicle and manubrium due to MRSA.

Keywords: Methicillin-Resistant *Staphylococcus Aureus*; Manubrium Osteomyelitis; Diabetic Foot Infections; Diabetes Mellitus

Introduction

Staphylococcus aureus (*S. aureus*) is a gram-positive, coagulase-positive pathogen belonging to the family Staphylococcus and forms grape-like clusters when viewed under a microscope. *S. aureus* can cause mild skin infections such as cellulitis and fatal illnesses like sepsis and multi-organ failure [1,2]. Key to this bacteria's inflammatory process are the toxins, enzymes, and various proteins and peptides that it releases. In addition to activating inflammatory cells, *S. aureus* can also perpetuate host cell death through apoptosis, pyroptosis, necroptosis, and autophagy [2]. Over time, the increasing use of antibiotics to treat *S. aureus* infection has led to adopting mechanisms to resist these medications and complicating treatment. For example,

there are now Methicillin-Resistant *Staphylococcus Aureus* (MRSA), first identified in the United Kingdom in 1960 and now pervasive in our communities, animals, and foods. Of note, MRSA accounts for at least 25-50% of nosocomial *S. aureus* infections [1]. In addition to *S. aureus*' infectious profile, MRSA displays a strong propensity towards the presence of atopic dermatitis, psoriasis, pulmonary cystic fibrosis, allergic asthma, pneumonia, food poisoning, chronic granulomatous disease, osteomyelitis, Diabetic Foot Infections (DFIs), and among other diseases [2]. Here we are presenting a case of MRSA infection of the medial clavicle and manubrium in an older diabetic male who presented with left shoulder pain and shortness of breath.

Case Presentation

Our patient is a 56-year-old male with past medical history of type 2 Diabetes Mellitus (DM), hypertension, and benign prostatic hypertrophy who presented to the Emergency Room (ER) with left shoulder pain and neck pain that radiated to his back with accompanying Shortness of Breath (SOB). The patient's history of DFI involving his left lower extremity secondary to peripheral neuropathy led to a left below-knee amputation. He had chronic wounds involving the left below-knee amputation, which have entirely resolved, but he mentions having previous MRSA infections.

On inquiry, he attributed his discomfort and pain to an idiopathic pulled muscle, denying any precipitating trauma to the left shoulder. He divulged visiting the ER a week ago with left shoulder pain, later revealed as a left pectoralis hematoma on a chest Computed Tomography (CT) scan without contrast (Fig. 1). He followed up with an orthopedic doctor in an outpatient setting. During his subsequent visit, the orthopedist noted SOB and suggested to meet with a pulmonologist that later prompted the patient's current visit to the hospital.

In the ER, his vitals were blood pressure 134/65 mm Hg, heart rate 110 beats/minute, respiratory rate 20, saturating 99% on room air and temperature of 97°F. Physical examination revealed tenderness around the left shoulder joint radiating medially to clavicle and posteriorly to scapula, reduced range of motion of left shoulder. There was no appreciable redness, swelling or trauma. A chest CT for Pulmonary Embolism (PE) protocol ruled out a PE but reconfirmed the presence of a left costoclavicular abscess with an edematous enlargement of the left pectoralis musculature, predominantly medially, with some erosive changes of the left clavicular head. An Ultrasound (US) duplex was performed on the left upper extremity, which revealed complex fluid collection in the pectoralis muscle being highly suspicious of infectious etiology (Fig. 2). A chest Magnetic Resonance Image (MRI) showed osteomyelitis of the left clavicular head and an adjacent manubrium and soft tissue mass surrounding the clavicular head compatible with phlegmonous collection or abscess (Fig. 3).

The patient underwent Incision and Drainage (I&D) of the abscess at proximal clavicle and first rib, with the insertion of a drain for continued treatment leading to a mild improvement of symptoms. However, considerable pain around the left side of his chest remained. At the time of the procedure, a blood culture was taken, which revealed MRSA sensitive to vancomycin, daptomycin, ceftaroline and telavancin. As per the Infectious Disease physician's recommendation, he was switched from the initial administration of Intravenous (IV) vancomycin 1 g daily to IV daptomycin 950 mg daily and started on IV hydromorphone at 1 mg every four hours as needed.

He underwent a Transesophageal Echocardiogram (TEE) which revealed no vegetation on his valves. Repeat blood culture returned negative, and the patient was scheduled for discharge with a Peripherally Inserted Central Catheter (PICC) line for six weeks of antibiotic treatment. Patient education included reinforcement of the importance of glucose monitoring and appropriate insulin use. Follow up visit in 6 weeks showed well healing surgical site with no acute symptoms and PICC was removed after antibiotic course completion.

Discussion

S. aureus has a protein called SpA in its cell wall, which can bind with human immunoglobulin to form a complex related to immune cells' necrosis. More significant is that SpA is considered a part of the cascade leading to osteomyelitis [2]. Osteomyelitis is an infection of the bone, most commonly in the long bones of children and in the spine of adults, and can present with fever, pain, and swelling. Certain factors like diabetes, sickle cell anemia, and artificial joints can perpetuate osteomyelitis. As a result of this infection, abscesses and bone death are known complications [3].

The disease process begins with SpA forming a complex with the TNFR-1 found on osteoblasts. This complex then activates NF- κ B, an inducible transcription factor that can regulate cell growth and survival, which then causes the release of Interleukin-6 (IL-6). IL-6 is integral in bone repair and growth, but this osteogenic cell induces apoptosis and the inhibition of the mineralization of osteoblasts. With defunct osteoblasts, RANKL increases, leading to increased bone resorption and the eventual loss of bone. *S. aureus* also inhibits bone formation with the increased recruitment and utilization of alkaline phosphatase, collagen type I, osteopontin, and osteocalcin, thereby inhibiting bone formation [2].

A study in July 2022 evaluated 410 cases of malignant and non-malignant pathologies of the clavicle and discovered 39% of cases were infectious. Interestingly, infection of the clavicle was most seen in a younger patient population, specifically in those 20 years old or younger. Of note, their data recognized 73% of all lesions of varied etiology affected the medial clavicle [4]. Another systematic review performed in July 2019 evaluated a pooled analysis of 294 reported cases of clavicular osteomyelitis. This focused study revealed almost half the osteomyelitis cases were due to bacteria (146 cases), while the rest were of nonbacterial etiology (148 cases). It further expressed that this infection was more common in females, with an indicated median age at diagnosis being 16 years old. Osteomyelitis of the clavicle was also noted to have a chronic quality with a median symptom duration of four months. The most common symptoms were pain (192 cases), swelling (151 cases), and fever (52 cases). Of

pertinence is the total positive culture rate for bacterial osteomyelitis (81.82%), with *S. aureus* the most common offender (44.70%). Finally, this pooled analysis noted that the average cure rate was 83.52%, with no significant difference in treatment modalities [5].

The clinical presentation and the many diagnostic tests needed to achieve better care for our patient were very challenging in his course of treatment. While Erythrocyte Sedimentary Rate (ESR) and Complement Reactive Protein (CRPs) are not definitive, it is crucial to get a complete clinical presentation, serial laboratory values, and appropriately choose diagnostic modalities according to symptoms [4,5]. A similar case echoing a problematic diagnosis of osteomyelitis of the acromioclavicular bone not only highlighted the timing of a CT or MRI and continuous documentation of symptoms and lab results but to create an exhaustive list of differential diagnoses. All the information gathered about a patient helps to determine if more invasive care is needed. This case also reinforces patient education on health conditions, illness management, and outpatient follow-up [6].

Treatment and management of osteomyelitis require pathogen-specific antibiotic treatment over empiric treatment. For MRSA, vancomycin is the first-line treatment. Alternative antibiotic treatment to vancomycin is daptomycin, linezolid, or clindamycin. If, like in our patient, acute osteomyelitis is refractory to treatment or there is a chronic history of infection, surgical intervention may be necessary. Invasive treatment usually consists of necrotic bone and tissue debridement or even amputation in severe diseases. To avoid an indurated illness, early clinical diagnosis and treatment are vital. More apt is patient education, outpatient follow-up, and patient advocacy.

Conclusion

Methicillin-resistant *Staphylococcus aureus* is a bacterium found in community and hospital settings. Infection with this organism can lead to a complicated hospital course as treatment options require susceptibility studies for the best antibiotic use. Consideration to avoid further antibiotic resistance with the chosen pharmaceutical option is also essential. Osteomyelitis, especially of the medial clavicle and manubrium of our older male patient, is uncommon and can be challenging to treat. Furthermore, the time taken to diagnose osteomyelitis exacerbated the course of treatment. Learning point are we intend to highlight the importance of accurate and prompt diagnosis of osteomyelitis, especially in unique skeletal structures and unusual symptoms, to reduce adverse outcomes. Untreated or inadequately treated, MRSA can lead to various diseases, like osteomyelitis.

Conflict of Interests

The authors declare no conflict of interest regarding authorship roles or publication of article.

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Ethical Statement

Not applicable

Informed Consent Statement

Informed consent was obtained from the subject involved in the study.

Author's Contributions

All the authors have equal contribution and all the authors have read and agreed to the published version of the manuscript.

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Consent for Publication

Informed consent was obtained from the patient for publication of this case report and is stated in the manuscript.

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