

Impact of chronic osteomyelitis on wound healing and the quality of life of the patient with a chronic wound

ABSTRACT

Spinal cord injury (SCI) patients have a higher risk of developing pressure injury secondary to limited mobility and lack of sensation. The James J Peters Medical Center is one of several regional spinal cord injury centres in the Veterans Affairs System. Veterans with SCI receive comprehensive care. Hospital- and community-acquired pressure injuries (HAPIs and CAPIs) can progressively advance to chronic stage IV pressure injury complicated with osteomyelitis. Chronic wounds that become infected can lead to sepsis if the wounds are not managed properly. The management of chronic wounds represents a significant financial burden for any health care system and a challenge for providers whose goals are to avoid prolongation of hospital stay, avoid complications, and minimise disruption in the patient's life. A focus of the primary physician is to establish a rehabilitation plan that facilitates the patient to resume activities of daily living post injury and have a productive life in their community. However, despite the collaborative effort of the SCI team, the sudden change in the patient's mobility can also have a detrimental impact on the patient's mental status as well.

Keywords Chronic osteomyelitis, spinal cord injury, psychological impact.

For referencing Johnson-Kunjukutty S and Delille C. Impact of chronic osteomyelitis on wound healing and the quality of life of the patient with a chronic wound. WCET® Journal 2019; 39(2):34–40

DOI <https://doi.org/10.33235/wcet.39.2.34-40>

INTRODUCTION

The patient presented shows the pathogenic nature of spinal cord injury (SCI), the difficulty in managing, and the impact these wounds had on his quality of life. Even though the development of a pressure injury is widely known in the medical community, the complexity of the patient's medical conditions, the complications encountered along the way in the management of this patient's wounds, and the variability in diagnostic test results have largely contributed to delaying the healing trajectory. The anxiety and the depression the patient experienced since the development of his wounds are most likely linked to the chronicity of the wounds as well. This article is intended to raise awareness of the impact of chronic wounds on the individual's quality of life and the challenges faced by clinicians who cared for him.

CASE PRESENTATION

Joe is a 34-year-old, African-American, male veteran, who sustained T3 SCI that resulted in paraplegia after a motorcycle accident in 2004. He presented to James J Peters Medical Center in April 2009 with general malaise, ill feeling for one month, fever and chills. He had developed four pressure injuries at different stages of tissue degradation at home. The initial measurements of the wounds are as follows:

- Left trochanter: initially unstageable and progressed to stage IV pressure injury that measured 8 cm x 8.5 cm x 1.5 cm (Figure 1).
- Left gluteal: stage IV pressure injury that measured 4 cm x 4.5 cm x 3 cm with undermining from 3 to 8 o'clock that extended to 3 cm at 3 o'clock (Figure 2).
- Right trochanter: stage IV pressure injury that measured: 12 cm x 10 cm x 2.5 cm (Figure 3).
- Right gluteal: stage II pressure injury that later progressed to a stage IV pressure injury (Figure 4).

The admitting diagnosis was sepsis secondary to an infected stage IV pressure injury on left gluteal, greater trochanter of right femur. A bone scan obtained confirmed the presence of osteomyelitis of the left gluteal and the greater trochanter region of the right femur. The patient received initial treatment in the intensive care unit (ICU) and was transferred to the SCI unit two days later.

Swapna Johnson-Kunjukutty*

MD, IIWCC-NYU

James J Peters VAMC, Bronx, NY, USA

Columbia University School of Medicine, New York, USA

Email Swapna.Johnson-Kunjukutty@va.gov

Carmel Delille

RN, MSN, MHA, CWON

The James J Peters VAMC, Bronx, NY, USA

*Corresponding author



Figure 1: Left trochanter wound on admission, April 2009



Figure 2: Left gluteal wound on admission, April 2009



Figure 3: Right trochanter wound on admission, April 2009

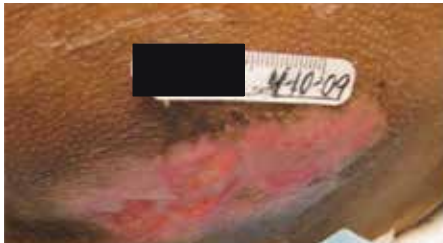


Figure 4: Right gluteal wound on admission, April 2009

TREATMENT

The patient was admitted to the ICU and empirically treated with broad-spectrum Vancomycin and Zosyn based on the clinical suspicion of wound infection. Bone cultures were not obtained prior to the administration of antibiotics. An infectious disease (ID) consultation was requested five days after admission, and the recommendation was to continue with the current selection of antibiotics for two weeks and switch to Levofloxacin PO for six weeks. He had surgical debridement of the left gluteal and left trochanter. A year later he had surgical excision and debridement of the right gluteal bone and the right trochanter.

The proximity of the bilateral gluteal wounds to the rectum predisposed this patient to recurrent infection from faecal contamination. He remained hospitalised for an extended period of time due to chronic osteomyelitis. In the interim, Joe's wound management included: culture of bone which grew *Staphylococcus aureus* (MRSA), wounds and bone debridement, 16 weeks of Bactrim DS, and application of several topical wound modalities. For a while there was a decrease in sedimentation (SED) rate, prealbumin improved, and over all, his physical appearance improved. However, he remained concerned and reluctant to get out of bed and he declined any involvement in recreational activities that were available to him.

The chronicity of his condition remained critical within his pelvis. In February 2011, Joe was reassessed for osteomyelitis by gallium scan and found to have positive results. The ID consultant recommended PICC line placement for six weeks of Daptomycin to treat the persistent MRSA found on wound cultures. In late 2011, Joe developed sepsis from the PICC line and consequently was transferred to the ICU for two

weeks. Upon his return to the SCI unit, his care was assigned to another physician. The issues identified on transfer of care were: iron deficiency, poor appetite, bouts of nausea, and chronically low pre-albumin. The patient appeared withdrawn and communicated his needs in very short sentences. He denied any depressive symptoms and declined offers to be seen by psychologist. Joe expressed interest in going home.

In December 2011, Joe went back to the operating room for excision and wound debridement of both gluteal pressure injuries and multiple bone biopsies after magnetic resonance imaging (MRI) confirmed the presence of chronic osteomyelitis. The bone biopsies grew MRSA and *Acinetobacter baumannii*. The patient developed tongue swelling to cephalosporins, so the ID physician recommended giving Daptomycin and Imipenem for 10 days followed by Bactrim DS for an extended course, with the duration to be determined by response on follow-up imaging.

Gastroenterology consultation was requested for evaluation of chronic inflammation and persistent weight loss. It was determined that the patient did not have inflammatory bowel disease and a colonoscopy was not recommended. A nutritional consultation was made subsequently and the patient's caloric intake was monitored. Furthermore, an appetite stimulant was prescribed. No improvement was noted in the patient's weight in the next four weeks that followed.

Joe's case was discussed with the interdisciplinary team, consisting of physicians, a general surgeon, a certified wound ostomy nurse, a dietitian, a psychologist, several occupational and physical therapists, and a social worker to provide a holistic approach. A trial of enteral feeding via nasogastric tube was initiated at night with continued oral intake during the day. As a result, the patient gained weight and there was noticeable improvement in the wounds' appearance. Specifically, the wound bed appeared 100% granular and the wound edges were contracting. A PEG tube was placed and Joe was in charge of doing the supplemental feeding in addition to his regular oral intake.

After a while, Joe did not adhere with the prescribed instructions and consequently a significant reduction in his weight was apparent and deterioration in the wounds' bed

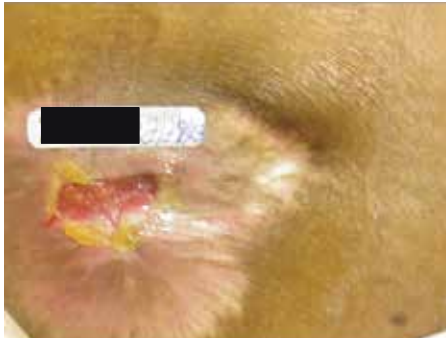


Figure 5: Right trochanter wound on discharge, February 2013



Figure 6: Right gluteal wound on discharge, February 2013



Figure 7: Left gluteal wound on discharge, February 2013



Figure 8: Right gluteal wound, December 2014



Figure 9: Right gluteal wound, November 2016

was noticeable as well. In our team discussion it was decided that a change in Joe's environment and the company of relatives might contribute in lifting his spirit. The patient was encouraged initially to spend the weekend at home with the ultimate goal of achieving total reintegration into the community. Joe was discharged home in 2013, nearly four years after his SCI admission, with three wounds:

- Right trochanteric wound 1.7 cm L x 0.9 cm W x 0.6 cm D (Figure 5).
- Right gluteal wound measured: 4.2 cm L x 3 cm W x 1.7 cm D with undermining circumferentially with the deepest part documented at 3.3 cm at 12 o'clock (Figure 6).
- Left gluteal wound 1.5 cm L x 1.2 cm W x 2.2 cm D, with undermining circumferentially that it extended to 3.1 cm at 12 o'clock (Figure 7).

At home, Joe had easier access to his food preferences and his nutritional status improved without the need of supplementation. He freely maintained his weekly schedule for follow-up assessments at the SCI outpatient clinic, with routine blood work including CBC, BMP, prealbumin, ESR and CRP obtained at least monthly. He continued to improve. His right trochanteric wound intermittently closed and re-opened. His left gluteal wound healed. His right gluteal wound periodically showed some improvement and then there was some regression in the healing process (Figure 8).

Two and a half years after discharge, an MRI of the pelvis was ordered; the findings were consistent with chronic osteomyelitis involving the right hip, predominately the right acetabulum posterior and medial walls. Findings were similar when compared with a diagnostic test obtained 18 months earlier. Joint effusion was present. An ID physician was therefore consulted. Her impression was:

Underlying osteomyelitis is clearly chronic in nature. Patient completed several courses of antibiotic in the past and administering another course of antibiotics will likely not cure his underlying osteomyelitis. The last culture was positive for an ESBL proteus mirabilis, which could be treated with Ertapenem IV daily. However, I recommend treatment only if patient is symptomatic with pain and erythema (like an exacerbation of his chronic osteomyelitis). Chronic suppressive antibiotics have been prescribed for chronic osteomyelitis; however, previous cultures grew an ESBL. There are no good oral options available and I do not think long term suppression is necessary, unless patient has frequent exacerbations. Would check quantitative C-reactive protein (CRP) and ESR now and definitely if he is taking any kind of AB (in case he becomes symptomatic). Otherwise no need to treat the patient with antibiotics for chronic osteomyelitis.

The provider, in agreement with the ID physician, did not support administration of long-term antibiotic suppression therapy, unless the patient experienced frequent



Figure 10: Right gluteal with connecting track, December 2016



Figure 11: Right gluteal post-debridement, March 2018



Figure 12: Right gluteal wound, June 2018



Figure 13: Right gluteal wound healed, August 2018



Figure 14: Right gluteal wound, June 2019

exacerbations. Joe's quantitative CRP and ESR were closely monitored, and antibiotic treatment was considered based on clinical presentations. The wound on the right gluteal showed slow but gradual improvement.

Two years later, a gallium scan was inconclusive for osteomyelitis (Figure 9). A year later, Joe received another short course of antibiotics for a wound infection based on culture results. Over the past years, the treatment plan for this patient included a variety of evidence-based dressings available on the market, namely: Collagenase™, Medihoney™, Plurogel™, Collagen, Oasis™, and Biologics Epifix™, Grafix™, and Hyalomatrix™ dressings were applied with the goal of achieving complete wound healing.

In December 2016, Joe developed another abscess between the right gluteal and the right trochanteric wounds. This abscess was drained and a few weeks later a tiny opening was noted that connects to the right gluteal wound, which formed a tract into the right medial fossa (Figure 10). This finding was confirmed by an MRI.

This superficial wound, unlike the previous abscess did not heal. Over the course of eight weeks, several topical treatments were applied, none of which were successful in facilitating the desired outcome. Since the wound showed no improvement, an MRI of the pelvis was ordered, which showed some mild marrow signal changes within the posterior column of the right acetabulum adjacent to this soft tissue process. Overall, marrow signal changes within the right acetabulum are decreased from the previous scan. At the time of the MRI, the impression was that there was overall improvement because of the decrease in marrow signal changes.

Joe's case was discussed during the wound care board committee. The committee suggested that biofilm might be the culprit impeding wound healing based on the clinical course. Their recommendation included pulse lavage followed by application of Plurogel™. This method was tried for one month without improvement. Next, a consultation for hyperbaric oxygen therapy was suggested but this treatment option was contraindicated because of Joe's past history of spontaneous pneumothorax.

The patient was referred to another institution for a second opinion. After reviewing MRI reports, the consulting wound care MD, in tandem with the radiologist at that health care facility, concurred that Joe still had chronic osteomyelitis, and recommendations included surgical debridement, a prolonged course of antibiotic and hyperbaric oxygen therapy concurrently. Hyperbaric oxygen was not pursued because of the patient's previous history of spontaneous pneumothorax. The consultant stated clearly that osteomyelitis of the pelvis in most cases is incurable. Aggressive debridement of the pelvis may result in poor sitting balance, which would have a devastating effect on Joe's overall well-being.

Follow-up wound assessment of all the wounds conducted revealed that the wound beds were covered with friable and pale tissue. A wound culture and sensitivity obtained initially grew multidrug-resistant MRSA, and later Proteus. The treatment plan included Bactroban and Bactrim for MRSA, but no improvement was observed after two weeks. Subsequently Ertapenem was added to treat the Proteus. He received Ertapenem 1 gm intramuscular daily administered by a visiting nurse. Joe's case was presented at an ID departmental meeting,

and a decision was made to administer a prolonged course of antibiotics based on Joe's clinical presentation.

After six months, the right gluteal wound had stalled and a decision was made to admit Joe and he finally agreed to proceed with a colostomy formation prior to an aggressive surgical debridement to facilitate management of the wound. In March 2018, bone cultures were taken at the time of debridement and showed persistent MRSA (Figure 11). Joe was given two doses of once-weekly Dalbavancin followed by four doses of once-weekly Oritavancin (Figure 12). His inflammatory markers improved and his wound healed by August 2018 (Figure 13). Joe's inflammatory markers were continually monitored and subsequently he was commenced on chronic suppressive therapy with minocycline 100 mg orally twice a day. Figure 14 represents complete right gluteal wound closure.

As health care providers, the treating multidisciplinary team had so many unanswered questions. At what point did the conversion from acute to chronic osteomyelitis occur? Was Joe not treated sufficiently? Could this have been managed differently? What about imaging? Why does it not provide a clear picture?

DISCUSSION

Labs to detect bone infection

It is known that X-rays do not reveal early osteomyelitis. They are effective in showing the damage caused by osteomyelitis such as sequestra; however, they do not expose the current activity level of the infection¹. A computerised axial tomography (CAT) scan may depict intramedullary and soft tissue gas, sequestra, sinus tracts, and foreign bodies. However, CAT scanning is insufficient for the assessment of the activity of the process¹. Nuclear imaging has high sensitivity for detecting evidence of inflammation and therefore tends to be more reliable for evaluation of acute infection than chronic infection. MRI has increased sensitivity and negative predictive value in osteomyelitis, especially for early disease¹. MRI often lags behind clinical improvement and sometimes it can remain abnormal in appearance for months post therapy¹. It is important to remember that imaging is intended to support the diagnosis, but is not exclusively diagnostic; it must be put in perspective with the entire clinical picture.

In Joe's case, his inflammatory markers were always high, so it was difficult to use that as a guide. On review, the last MRI report showed some:

... mild bone marrow signal changes within the posterior column of the right acetabulum adjacent to this soft tissue process, which may represent reactive marrow changes. In comparison, overall marrow signal changes within the right acetabulum are decreased from the previous examination.

The radiological findings did not clearly report osteomyelitis; consequently, the ordering physician interpreted this report as clinical improvement because of the decrease in marrow signal.

In retrospect, one can conclude that the findings are consistent with chronic osteomyelitis.

Antibiotic therapy

The choice of antibiotic selection, administration route and duration of treatment for osteomyelitis remain debatable, resulting in different recommendations from different infectious disease physicians. It is generally accepted that the adequacy of debridement with a wide excision remains the most important clinical predictor of a successful outcome^{2,3}. In Joe's case, taking him back to the operating room was a concern because aggressive debridement in that affected area would most likely have resulted in poor sitting balance in addition to a larger wound. Having all of his care at one centre provided continuity in the management of his care, and provided quick access to all his records, including previous antibiotic regimens. Joe developed allergies to two classes of antibiotics, including sulfa drugs and cephalosporins. Therefore, treatment options were limited. Our ID team recommended Oritavancin because in recent studies it has been well tolerated and has good efficacy. It is also effective for *S. aureus* and effective in treating osteomyelitis^{4,5}. We did an initial two weeks of Dalbavancin because it is similar to Oritavancin while we were awaiting procurement of Oritavancin⁶.

Quality of life issues

As clinicians and providers, after reflecting on the challenges of managing chronic wounds and overcoming obstacles that impede healing, we must consider the impact of chronic wounds on the patient. For Joe, the feeling of success and failure, and the uncertainty of his overall prognosis led to separate issues. When an individual believes that he is powerless in controlling what happens in his life, the adaptive skills become restrictive and often ineffective⁷.

In the hospital settings, Joe would try to be compliant with all pressure injury preventative measures. He would be very attentive to the wound care instructions and would enquire about indication for dressings and compare the benefits of one dressing over another. Joe did not demonstrate any obviously unhealthy behaviours; however, periodically he would neglect his appearance, not shaving or cutting his hair. He would often refuse the meals served at the hospital, or let the cans of supplement accumulate at the bedside. His sleeping pattern was inconsistent. At times he would pretend to be asleep to avoid talking or interacting with the nursing staff. For instance, he would state that he is remaining in bed to expedite the healing process. He planned his life around his wound care schedule. Often he verbalised that he "is waiting for the wound to heal" to initiate involvement in social settings and school enrolment. Often time his mood would be affected by the discussion about the status of the wounds. He would become quiet and withdrawn if it was reported that the wound did not show any improvement or become talkative and friendly if he received positive feedback.

It is documented that psychological distress may exert a clinically relevant impact on wounds⁸. Stress has been known

to reduce the amount of inflammatory mediators, prolonging the inflammatory stage of healing, thus increasing the overall healing⁸. Staff repeatedly reminded him that we do not have a time frame for his wound to achieve complete closure, and strongly discouraged him to place his life on hold.

Goals of care

A shared goal of our SCI multidisciplinary team was to continually encourage the patient entrusted to our care to adapt, advance, and to achieve their maximum potential after the injury. All care plans are focused towards achieving that goal. We work collaboratively to maximise the patient's quality of life to be the best it can be. Oftentimes in hospital settings the patient's medical condition takes priority. However, we need to consider factors such as sleep deprivation, psychological distress, stress, depression, pain, the length of hospital stay, and their impact on the patient's social life.

Joe's wounds below the level of his SCI deprived him of the ability to feel pain. It is reported that pain receptors are still triggering in those areas, thus causing local inflammatory responses that may inhibit the healing process^{9,10}. The literature also reveals that limited sleep decreases growth hormone secretion that results in decreasing monocyte migration, activation of microphages and protein deficiency. Consequently, capillary formation, collagen synthesis, and wound remodelling are decreased⁸.

Depression also has been linked to a delay in wound healing⁸. Joe never had a positive depression screen, but social isolation was apparent in his avoidance of activities or refusal to participate in trips arranged by the recreational therapist. His behaviour could be attributed to depression, but he denied depressive symptoms. Joe is a very clean individual and was very concerned about his surroundings being contaminated; the amount of exudate and the odour emanating from the wound have significantly contributed to self-social isolation. These aspects of chronic wounds have prevented him from considering companionship or having a meaningful relationship with a woman.

The importance of providing social support and reducing stress for Joe was crucial in promoting healing of his wounds. The multidisciplinary team strived to promote self-confidence in Joe by reminding him of his resilience, and his strength in overcoming and surviving his injury¹¹. It was continually reinforced that those two elements are key to achieving positive adaptation and experiencing an enjoyable life in the community.

CONCLUSION

People with SCI are prone to developing pressure injuries because of their limited mobility and lack of sensation. The wounds developed in this population of patients are often chronic or recurrent. Infected wounds can lead to sepsis and are often affected with secondary osteomyelitis. The management of these wounds is complex and they represent a tremendous financial burden for the medical institution.

In addition, they significantly disrupt the patient's way of life despite the provider's best efforts to encourage and assist the patient in regaining some type of control in their environment and having a normal, productive life.

The SCI multidisciplinary team has witnessed the detrimental impact of these types of chronic wounds on our patient's quality of life, and the presence of osteomyelitis in these wounds render their management even more complex. Joe's case helped the SCI team realise that sometimes too much emphasis is placed on radiologic diagnosis. The literature states that imaging is considered a supportive test but is not diagnostic. It is crucial that a comprehensive multidisciplinary approach be implemented from the beginning to ensure that a positive outcome is achieved, thus avoiding lasting complications. During the journey in managing Joe's wounds, the SCI team realised the importance of identifying and selecting a treatment plan that would be most beneficial for Joe's overall well-being. The goal was to ensure that complete wound closure was achieved promptly, to enable Joe to reach his maximum potential post injury.

Health service providers and clinicians must always consider the possibility that chronic osteomyelitis may be the causative factor in chronic, non-healing soft tissue wounds¹². To ensure the appropriate treatment is implemented early, to mitigate long-term effects and avoidable suffering for the patient and to shorten hospital stay and contain costs, a definitive diagnosis is essential. As clinicians, it is clear that the management of complex wounds requires interprofessional collaboration to address every component that may impede wound healing. When in doubt, clinicians should not hesitate to request consultation from other expert providers to ensure that the patient is well informed and receives the best possible care.

ACKNOWLEDGEMENTS

We would like to thank the SCI and ID teams at James J Peters VAMC as well as Dr Kathleen Capitolo for support, encouragement and comments on earlier versions of the manuscript.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

FUNDING

The authors received no funding for this study.

REFERENCES

1. Khan AN. Chronic osteomyelitis imaging. Medscape 2017 September. <https://emedicine.medscape.com/article/393345-overview>
2. Spellberg B & Lipsky BA. Systemic antibiotic therapy for chronic osteomyelitis in adults. Clin Infect Dis 2012 Feb; 54(3):393–407 <https://www.ncbi.nlm.nih.gov/pubmed/22157324>
3. Panteli M & Giannoudis PV. Chronic osteomyelitis: what the surgeon needs to know. EFORT Open Rev 2016 May; 1(5):128–135 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5367612/>

4. Brade KD, Rybak JM & Rybak MJ. Oritavancin: A new lipoglycopeptide antibiotic in the treatment of gram-positive infections. *Infect Dis Ther* 2016 February; 5. <https://link.springer.com/article/10.1007%2Fs40121-016-0103-4>
5. DelapRightas DJ, Estrada SJ & Darmelio M. Successful treatment of methicillin susceptible *Staphylococcus aureus* osteomyelitis with oritavancin. *Pharmacotherapy* 2017 Aug; 37(8):e90–e92. <https://www.ncbi.nlm.nih.gov/pubmed/28543367>
6. Rappo U, Puttagunta S, Scevchenko V *et al.* Dalbavacin for the treatment of osteomyelitis in adult patients: a randomized clinical trial of efficacy and safety. *Open Forum Infect Dis* 2019 January; 6(1), <https://academic.oup.com/ofid/article/6/1/ofy331/5235615>
7. Rohatinsky N, Goodridge D, Rogers MR, Nickel D & Linassi G. Shifting the balance: conceptualizing empowerment in individuals with spinal cord injury. *Health Soc Care Community* 2017 Mar; 25(2):769-779 <https://www.ncbi.nlm.nih.gov/pubmed/27400830>
8. House SL. Psychological distress and its impact on wound healing: an integrative review. *J Wound Ostomy Continence Nurs* 2015 Jan–Feb; 42(1):38–41 <https://www.ncbi.nlm.nih.gov/pubmed/25549307>
9. Woo Y. Exploring the effects of pain and stress on wound healing. *Adv Skin Wound Care* January 2012; 25(1):38-44 https://www.nursingcenter.com/cearticle?an=00129334-201201000-00010&Journal_ID=54015&Issue_ID=1287313
10. Bechert K & Abraham SE. Pain management and wound care. *J Am Coll Certif Wound Spec* 2009 Apr; 1(2):65–71. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3478916/>
11. Ousey K & Edward K-L. Exploring resilience when living with a wound — an integrative literature review. *Healthcare (Basel)* 2014 Sep; 2(3):346–355. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934596/>
12. Lalani T & Schmitt SK. Osteomyelitis in adults: Clinical manifestations and diagnosis. UpToDate Literature review current through: May 2019. Updated 28 March 2019 <https://www.uptodate.com/contents/osteomyelitis-in-adults-clinical-manifestations-and-diagnosis>