

Surgical treatment of osteomyelitis of the jaws in drug addicts

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ABSTRACT

Background: Toxic osteomyelitis of the jaws is a serious condition in intravenous drug users, often leading to severe bone damage and requiring complex surgical interventions.

Aim: This case report highlights the surgical treatment and post-operative challenges in patients with toxic osteomyelitis who have a history of intravenous drug use.

Methods: three cases of intravenous drug users with toxic osteomyelitis were reviewed. These patients underwent either hemi mandibulectomy or total jaw resection, followed by reconstruction using titanium plates. Intraoperative photos and radiographs documented their surgical progress and recovery.

Results: Recovery was hindered by delayed healing and increased risk of infection, largely due to ongoing drug use. These cases emphasize the importance of early dental intervention to prevent such severe complications.

Conclusions: Early involvement of dental professionals is key in preventing toxic osteomyelitis and reducing the need for extensive surgery, ultimately improving patient outcomes.

Keywords: Toxic Osteomyelitis, Hemi mandibulectomy, Osteonecrosis, Reconstruction, Intravenous Drug use

INTRODUCTION

Osteomyelitis, one of the oldest known bone infections, has been documented throughout history, with evidence of its existence dating back millions of years. Hippocrates first described the condition, and by the late 18th century, it was more clearly understood as an internal infection of the bone marrow. Advancements in medical science eventually led to the identification of staphylococci and other microbes as primary causative agents of osteomyelitis (Klenerman & Surgery, 2007).

Toxic osteomyelitis of the jaws, a particularly severe form of this infection, is often associated with intravenous drug use, especially substances containing harmful chemicals like red phosphorus, iodine, and ephedrine (Stefanet & Rusu-Radzichevici, 2024). This condition presents as a diffuse, destructive necrotic process in the jaws and is characterized by an aggressive and atypical disease course (Fitkalo et al., 2021). While uncommon, osteomyelitis can lead to severe complications, including pathological fractures and septicemia (González-Navarro et al., 2017). Risk factors include tooth extraction, infections, and mandibular fractures, with tooth extraction being a key trigger (de França et al., 2021). Management typically requires both surgical intervention, such as sequestrectomy, and comprehensive antibiotic therapy (de França et al., 2021; Fitkalo et al., 2021).

Osteomyelitis of the jaw can occur in the mandible or maxilla and presents in several forms, including acute, primary chronic, and secondary chronic osteomyelitis (Akshayaa & Ramani, 2021; Kaur et al., 2024). Common symptoms include fistula formation, pus drainage, and bone sequestration (Kaur et al., 2024). Treatment often involves surgical debridement combined with antibiotic therapy, with intravenous antibiotics proving more effective than oral administration. The prevalence of osteomyelitis has decreased in developing countries due to improved oral hygiene and the availability of antibiotics (Akshayaa & Ramani, 2021). However, patients with compromised immune systems, such as those affected by COVID-19, face a higher risk of severe complications due to immune dysfunction and microvascular changes (Kvolik Pavić & Zubčić, 2022). Prompt diagnosis and appropriate treatment are critical for avoiding severe complications and improving patient outcomes.

Osteomyelitis, can result from various causes, each presenting distinct challenges in terms of treatment and prognosis. One particularly complex form is osteomyelitis associated with intravenous drug use. In these cases, substance abuse directly impairs the body's immune response and healing process, often leading to delayed recovery, poor compliance with medical care, and an increased risk of complications such as infections and implant failures. The use of substances like crystal meth is especially damaging, as it causes significant destruction of both soft and hard tissues in the oral cavity. Methamphetamine, for instance, induces vasoconstriction, limiting blood flow and raising blood pressure, which creates a condition ripe for necrosis and infection (Walter & Renné, 2021).

In contrast, bisphosphonate-related osteomyelitis occurs in patients undergoing treatment for osteoporosis or metastatic cancers. Bisphosphonates, which work by inhibiting bone resorption through the suppression of osteoclast activity, inadvertently increase the risk of

osteonecrosis, particularly in the jawbone (Walter & Renné, 2021). This form of osteomyelitis is often triggered by invasive dental procedures and necessitates the removal of necrotic tissue. Unlike drug-related osteomyelitis, bisphosphonate-induced cases are tied to medical treatments rather than behavioral factors like substance abuse. The condition arises from the interference in the bone remodeling process caused by bisphosphonates, which impairs healing and increases the likelihood of infection.

Similarly, osteomyelitis related to other medications, such as denosumab and certain tyrosine kinase inhibitors like sunitinib and imatinib, involves disruption of bone remodeling through altered osteoclast function (Walter & Renné, 2021). Although these cases may not cause as severe damage to the soft tissues and vascularization as drug-related osteomyelitis, patients are still at risk for delayed healing and infections. The pathogenesis is closely related to the suppression of osteoclasts, which impairs bone turnover and contributes to necrosis, though it may not result in the same level of tissue destruction observed in cases involving drug abuse.

Radiation-induced osteomyelitis, often referred to as osteoradionecrosis, typically affects individuals who have undergone radiation therapy for head and neck cancers. This condition arises from the radiation damage to the bone's blood vessels, particularly in the mandible, leading to necrosis (Walter & Renné, 2021). Unlike drug-related osteomyelitis, which is exacerbated by ongoing substance use, osteoradionecrosis is a consequence of the irreversible effects of radiation on the bone and surrounding soft tissues, particularly when high doses are used. The condition often requires significant surgical intervention, including bone removal.

Despite the varying causes, the prognosis for osteomyelitis depends heavily on early diagnosis and treatment. Drug-related osteomyelitis, especially when driven by substances like methamphetamine, tends to have a poorer prognosis due to patient non-compliance and severe tissue damage. In contrast, osteomyelitis caused by medications or radiation may follow a more predictable course, though all forms require prompt and aggressive management to prevent complications such as bone resorption, infection, or fractures. Early intervention, along with careful management of the underlying cause—whether it be substance use, medication side effects, or radiation damage—is critical to improving patient outcomes (Walter & Renné, 2021).

Osteomyelitis of the jaws is commonly categorized into acute and chronic forms, further classified based on clinical presentation, radiology, etiology, and pathological anatomy. Acute osteomyelitis is often triggered by trauma, surgery, or odontogenic infections and can progress due to secondary factors like burns, sinusitis, or vascular insufficiency. In some cases, particularly in children with developing skeletal systems, osteomyelitis can spread hematogenously (Baltensperger & Eyrich, 2009).

Chronic osteomyelitis, on the other hand, typically presents as a recurrent multifocal condition, more common in younger individuals, and may progress to more severe forms. One example is Garré's osteomyelitis, which is characterized by a proliferative subperiosteal

reaction. Another variant, diffuse sclerosing osteomyelitis, involves a compromised host-pathogen interface and fastidious microorganisms, making it particularly challenging to treat. Classifications also consider the pathogenesis of the condition, distinguishing between infections spread hematogenously, from a contiguous focus, or involving vascular insufficiency. Chronic suppurative forms, like Garré's osteomyelitis and chronic diffuse sclerosing osteomyelitis, require particularly careful management due to their complexity (Baltensperger & Eyrich, 2009).

This article focuses on toxic osteomyelitis of the jaws, often linked to the use of synthetic narcotics. These cases typically affect a younger population, requiring extended hospitalization, prolonged postoperative care, and constant observation. In Georgia, desomorphine, a morphine-like substance, is a common culprit. Known for its highly toxic effects, desomorphine rapidly induces severe complications that affect both internal organs and the skeletal system.

Patients with toxic osteomyelitis of the jaws often present with exposed bony tissue, spontaneous tooth loss, foul odor, and an unpleasant taste from the oral cavity. Facial asymmetry due to inflammation is also common, with patients displaying soft tissue deficits and draining fistulas, both intraorally and on the skin. Most cases require surgical intervention, typically involving debridement, intravenous antibiotic therapy, and reconstruction of bone defects and dental arches with complex reconstructive procedures.

Importantly, many patients with toxic osteomyelitis avoid formal medical treatment due to previous negative healthcare experiences, a lack of understanding of the disease's severity, or fear of stigma. As a result, they often turn to self-medication, allowing the condition to progress until it reaches a critical stage.

The aim of this case report is to explore the clinical challenges and surgical management of toxic osteomyelitis of the jaws in patients using intravenous drugs, specifically focusing on cases related to desomorphine. By presenting detailed case studies with intraoperative photos and radiographic images, the report seeks to provide a clear, step-by-step overview of the surgical procedures performed and the complexities of postoperative care in these patients.

METHOD

three cases of intravenous drug users with toxic osteomyelitis were reviewed. These patients underwent either hemimandibulectomy or total jaw resection, followed by reconstruction using titanium plates. Intraoperative photos and radiographs documented their surgical progress and recovery. The operations for all three cases were performed at Aleksandre Aladashvili Clinic in Tbilisi, Georgia, in the Department of Oral and Maxillofacial Surgery and Dental Implantology, by Professor Zurab Chichua and his team.

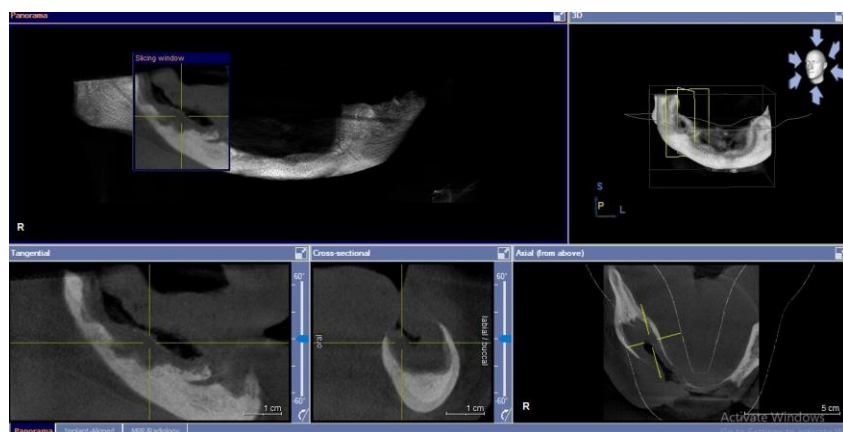
RESULTS

Case 1

A 45-year-old male presented to our hospital with severe pain and swelling in the lower jaw, accompanied by draining fistulas in the oral cavity. The patient also reported limited movement of the mandible and difficulty eating. During the examination, the patient informed us that he had been using intravenous drugs for 7 years.

Upon clinical examination, there was noticeable swelling of the soft tissues in the mandibular region, which was tender to palpation. Intraoral inspection revealed multiple draining fistulas with purulent exudate. Based on clinical and radiographic findings (Figure 1), a diagnosis of toxic osteomyelitis of the mandible was established.

Figure 1.



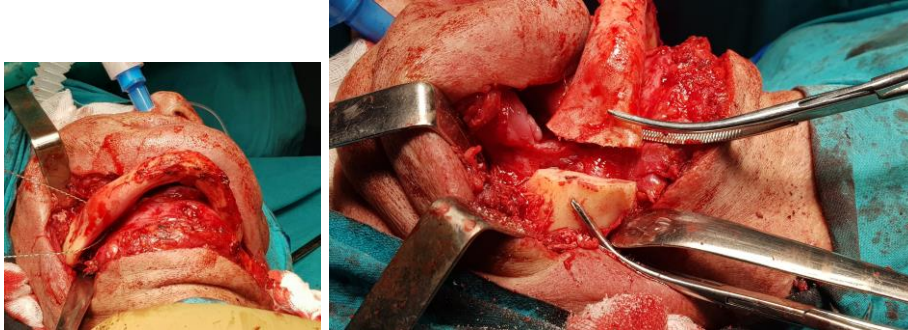
A treatment plan was developed involving partial resection of the mandible, followed by immediate reconstruction using a titanium plate and screws during the same surgical procedure.

The operation was performed under general anesthesia. An incision was made in the submandibular region, extending from one angle of the mandible to the other, approximately 2 cm below the lower edge of the mandible (Figure 2). The incision was carried through the skin and subcutaneous fat. Soft tissue dissection was performed using blunt and semi-sharp techniques. Hemostasis was achieved with ligation of the facial artery and vein.

Figure 2



Using specialized surgical instruments, the mandible was exposed. A fragment of the mandible was resected from both ascending rami within healthy tissue margins using a drill and a jigsaw (Figure 3). The sharp bone edges were carefully smoothed to prevent future trauma (Figures 4,5).



A titanium plate was contoured to replicate the natural shape of the mandibular body and angles as closely as possible (Figure 6). It was secured with titanium screws at the level of the ascending rami (Figure7).



After ensuring proper hemostasis, the wound was closed (Figure 8).

The resected tissue was sent for histopathological examination (Figures 9,10). Postoperatively, the patient was treated in the intensive care unit, receiving antibiotic therapy, drug therapy, and regular surgical wound dressings for both intraoral and extraoral sites.



postoperative radiological study (Figures 11,12)



The healing process was prolonged due to challenges associated with osseointegration of the titanium plate with the surrounding bone. Additionally, there was a significant risk of secondary osteomyelitis. Nonetheless, with diligent postoperative care and monitoring, combined with the patient's adherence to follow-up appointments and strict compliance with medical recommendations and prescribed treatments, these potential complications were successfully avoided.

However, the patient did not return for the planned further reconstructive surgery of the lower jaw.

Case 2

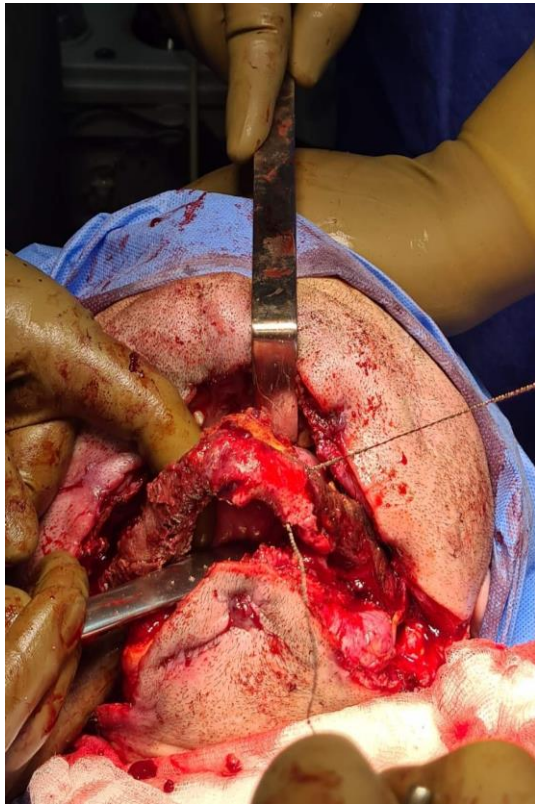
A 33-year-old male presented to our hospital with severe pain in the mandibular region, along with difficulty eating, speaking, and opening his mouth. These symptoms had persisted for two months (Figure 13). The patient reported that he had been injecting a drug named 'Krokodil' intraorally for the past couple of years.



The patient underwent surgery under general anesthesia. An incision was made 2 cm below the lower edge of the mandible, extending from one angle of the jaw to the other (Figure 14). The skin and subcutaneous fat were dissected.



The underlying tissues were bluntly separated, and the mandible was exposed. Using a Jigsaw, the bone was sectioned in the mental region (Figure 15), and a complete resection of the mandible was performed to facilitate exarticulation.



Following the resection, the wound was irrigated with aseptic solutions. Two polyethylene tube drains were inserted and secured to the wound with sutures. The image provided shows the exarticulated mandible (Figure 16).



Following the initial surgery, the patient faced a slow and challenging recovery, with ongoing difficulties in chewing and occasional pain reported five months post-operation. Reconstructive options, such as a titanium plate, were considered, but due to the large wound and high risk of complications, immediate reconstruction at the time of resection was not feasible. The decision was made to postpone reconstruction, allowing the wound to heal sufficiently and reducing the chances of implant failure or infection.

Case 3

A 53-year-old patient presented to the maxillofacial department with severe facial asymmetry due to significant soft tissue swelling. The patient had draining fistulas in the submandibular and submental regions and difficulty opening the mouth. The alveolar ridge was exposed, accompanied by necrosis of the mucosa, both vestibularly and lingually. Additionally, the patient reported hypersalivation while eating and difficulty speaking. The patient disclosed that he had been an intravenous drug addict for 14 years.

Based on clinical examinations and CT scans, a diagnosis of toxic osteomyelitis was established.

The patient underwent surgery under general anesthesia (Figure 17), during which a mandibular resection was performed from one angle of the mandible to the other (Figure 18). In the same operation, the defect was reconstructed with a titanium plate (Figure 19)



Due to the patient's history of intravenous drug use, despite adherence to postoperative care and recommendations, osseointegration of the titanium plate with the mandibular bone was unsuccessful. Three months after surgery, the patient returned to the department with complications, including significant exposure of the implant extraorally (Figure 20). This complication necessitated a secondary procedure to remove the titanium implant.

Managing patients with a history of drug abuse is particularly complex, as their compromised healing ability greatly heightens the risk of postoperative complications. In this case, the patient's ongoing substance use interfered with both the recovery process and the potential for successful reconstruction. This highlights the critical need for thorough follow-up and individualized treatment plans when caring for high-risk patients like these.



DISCUSSION:

The cases presented in this report highlight the substantial challenges encountered when treating toxic osteomyelitis of the jaws in intravenous drug users. The severity of the condition was evident across all cases, necessitating extensive surgical interventions, including mandibular resections and reconstructions with titanium plates. Although these procedures were technically successful, postoperative complications were prevalent, primarily due to ongoing substance abuse and patients' non-compliance with medical recommendations.

Research by Attie et al. (2018) similarly emphasizes the difficulties posed by substance abuse when treating osteomyelitis, particularly in drug users. Their study illustrates how individuals with a history of heroin use, much like the patients in this report, experience impaired immune responses. This impaired immunity complicates infection treatment and contributes to poor postoperative outcomes. Their findings align with the cases presented here, where substance abuse was a significant factor in impaired healing, necessitating complex surgical procedures.

These cases illustrate the complexities of treating patients with a history of intravenous drug use, where ongoing substance abuse impairs both the healing process and postoperative recovery, complicating surgical outcomes. Successful management requires a multidisciplinary approach that addresses the medical and psychosocial challenges faced by these patients.

Further supporting these observations, Yuschak et al. (2019) discuss the unique challenges of treating osteomyelitis in opioid users, who tend to develop the condition at a younger age and require longer hospital stays compared to diabetic patients. Due to compromised immune systems, these patients often need extended intravenous antibiotic treatments, and their non-compliance with medical care further complicates the treatment process. This is consistent with other research that highlights delayed healing and an increased risk of infections in drug users suffering from osteomyelitis.

Similarly, the work of Fitkalo et al. (2021) underscores the complexities of treating toxic osteomyelitis in drug users, particularly the delayed healing, high infection rates, and necrosis frequently seen in this patient population. Prolonged drug use, especially of homemade substances, causes severe bone destruction, making aggressive surgical interventions necessary. Their study also emphasizes that poor compliance with postoperative care is common among drug users, further exacerbating surgical complications and hampering long-term recovery.

These findings align with existing literature on osteomyelitis treatment in drug users, where delayed healing, high infection rates, and poor osseointegration of implants are recurring challenges. It has been demonstrated that intravenous drug use, especially substances like pervitin containing red phosphorus and ephedrine, significantly compromises bone healing. This is primarily due to the suppression of tissue metabolism and the onset of vascular sclerosis, which leads to osteonecrosis, further complicating recovery and surgical outcomes (Stefanet & Rusu-Radzichevici, 2024). Additionally, non-compliance with follow-up care remains a prevalent issue in this population, further increasing the risk of postoperative complications.

We as clinicians should try to improve long-term engagement with patients suffering from toxic osteomyelitis, especially those with histories of substance abuse, clinicians can implement several strategies. Patient non-compliance often complicates recovery, but with thoughtful follow-up care plans, these challenges can be addressed.

Clear communication is essential. Many patients may not fully grasp the importance of their follow-up care, so ensuring they understand both the severity of their condition and the potential risks of non-compliance is key. Motivational interviewing could be used to help patients take an active role in their recovery, fostering a sense of responsibility and improving adherence to care plans.

Frequent, accessible follow-up appointments should be offered to monitor healing and intervene early when complications arise

Integrating addiction support into the treatment plan is another crucial step. Involving addiction specialists can help address the root cause of non-compliance—ongoing substance abuse. Offering support for addiction treatment alongside medical care can improve the likelihood of successful recovery.

Engaging family members or caregivers in the process can also be beneficial. Having a support system involved can increase patient accountability and encourage them to follow through with appointments and treatments.

These strategies not only address medical needs but also the behavioral aspects that often hinder recovery.

CONCLUSION:

The cases presented in this report highlight the formidable challenges in managing toxic osteomyelitis of the jaws in intravenous drug users. These patients often present with severe bone destruction and complications that require extensive surgical interventions, including mandibular resection and reconstruction with titanium plates. However, despite the technical success of such procedures, postoperative complications remain prevalent, primarily due to ongoing substance abuse, poor patient compliance, and the delayed healing associated with drug toxicity.

The complexity of treating these cases was evident in several factors, such as delayed osseointegration, high infection risk, and the need for additional surgical procedures. In some cases, as illustrated in this report, patients did not adhere to follow-up care, which further compromised recovery. The decision to delay reconstruction in one patient due to a large bony and soft tissue defect was crucial in managing the risk of postoperative complications. In another case, implant failure due to poor osseointegration required a secondary procedure, underscoring the difficulties in achieving long-term surgical success in this patient population.

These findings reinforce the necessity of a multidisciplinary approach that not only focuses on the surgical management of toxic osteomyelitis but also addresses the underlying substance abuse issues. Early intervention, comprehensive postoperative monitoring, and psychosocial support are critical to improving patient outcomes and preventing the need for further surgical interventions. Effective treatment of these patients requires a collaborative effort between dental professionals, surgeons, and addiction specialists to ensure that both the medical and behavioral aspects of care are adequately addressed.

The cases discussed highlight the need to go beyond addressing immediate surgical concerns and focus on providing patients with tailored, long-term care strategies. A crucial recommendation is the inclusion of addiction treatment as part of the recovery process, helping to address the underlying factors contributing to non-compliance. Strengthening support systems and actively involving patients in their care plans can significantly reduce the risk of recurrence and improve long-term outcomes. These approaches are essential for minimizing complications and ensuring better recovery in this particularly challenging patient population.

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