

Intravenous Drug Abuser Treated for Chronic Infected Open Forearm Fracture with Shortening and Primary Wound Closure

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Summary: Neglected and open forearm fracture wounds accompanied by shortening are complex injuries that are seldom reported in the known literature. We describe a patient with a history of chronic intravenous drug abuse (IVDA) and a neglected forearm wound with radius and ulna fractures with chronic osteomyelitis managed by limb salvage. The patient had a history of IVDA and a neglected forearm wound with fractures in both the radius and ulna, along with chronic osteomyelitis. The approach taken to manage this complex injury involved limb salvage. The case emphasizes the treatment challenges associated with patients who had IVDA and neglected their wounds. Thorough evaluation combining clinical and radiological assessments, followed by appropriate surgical planning and intervention, played a crucial role in restoring the functional status of the limb. Neglected open fracture wounds in the forearm are uncommon and have limited documentation in the existing literature. The described patient's chronic history of IVDA and the disregarded open forearm osteomyelitis exemplify the severe consequences that can arise from injectable drug abuse in the upper extremity. In such cases, limb preservation and optimization of functional outcomes become paramount. To the best of our knowledge, this is one among the few reported cases of this nature, highlighting the significance of sharing such experiences to enhance medical understanding and inform future treatment approaches. (*Plast Reconstr Surg Glob Open* 2023; 11:e5465; doi: [10.1097/GOX.0000000000005465](https://doi.org/10.1097/GOX.0000000000005465); Published online 20 December 2023.)

A 43-year-old man with history of IVDA, smoking, and on methadone treatment presented with an open wound on his left forearm (Fig. 1). Wound neglect resulted in superficial infection spreading to subcutaneous tissue, ulcerating the skin and infecting both forearm bones. The patient declined treatment and neglected the wound, leading to the progression of osteomyelitis. In October 2021, he experienced a motor vehicle accident, causing the weakened, infected bones to fracture and protrude about 3 cm. The arm had an open wound for approximately 4 months, during which time intravenous drug abuse (IVDA) continued, before presenting to us.

The patient had a wound on his left dorsal forearm on the medial third, measuring 6 cm × 10 cm, with radius and ulna exposed and angulated dorsally, surrounded by necrotic tissue with ill-defined borders. Pain, redness, local rise in temperature, and discharge were absent. The patient had no active extension but had intact finger flexion, with a power of 2 of 5 (Medical Research Council). Active wrist and forearm movements were absent. Neurovascularity was intact. He was diagnosed with Gustilo-Anderson type II open segmental radius and ulna middle-third shaft fracture with infective nonunion and large chronic open soft-tissue defect (Fig. 2).

Radiographs indicated a soft-tissue defect with the radius and ulna mid-third shaft fracture and dorsal angulation with chronic cortical erosions and lysis consistent with osteomyelitis. Intraoperative wound cultures demonstrated growth of *Alcaligenes faecalis*, methicillin-resistant *Staphylococcus aureus*, and *Citrobacter freundii* complex.

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The procedure was planned in a single stage to eradicate infection and get forearm stability along with soft-tissue closure. The procedure was segmental resection of both forearm bones, wound debridement, antibiotic



Fig. 1. A photograph on initial presentation to the hospital of the left forearm with exposed soft tissue, radius and ulna, associated with osteomyelitis following trauma (used with permission).



Fig. 2. Preoperative lateral view radiograph of the left forearm with wrist joint of the patient on presentation, indicating exposed radius and ulna from the soft tissue with sclerotic changes (used with permission).

cement-coated intramedullary rod to ulna, and primary complex wound closure with vacuum-assisted closure placement. Complex wound repair was initiated at the beginning of the case, starting with an S-shaped incision so that acute shortening would allow soft tissue distally and proximally to approximate. Dorsal arm incision exposed bones, removing proximal radius to healthy distal radius and ulna. The extensor tendons were retracted proximally and were missing approximately 10 cm. They were retracted into the wrist and proximal arm. Necrotic soft tissue was excised, and irrigation with normal saline was done. The ulna was reamed to accommodate a slim nail (4.8 mm diameter, 150 mm length) and antibiotic mixture (0.6 g tobramycin and 1 g vancomycin per 20 mL of calcium sulfate) was injected into the bone canals.¹ The slim nail was inserted, shortening the forearm by 7 cm. Vascularity was confirmed, and the wound closure was performed with a wound vacuum-assisted closure application over primary closure and not on any raw area. Postoperative X-rays showed no abnormalities. The arm exhibited good blood flow, was monitored both intra- and postoperatively by ultrasound Doppler, and was placed in a U-splint. Follow-up examinations at 3 months revealed normal clinical, radiological, and laboratory findings without any signs of infection. The patient received 1.25 g intravenous vancomycin, 2 g cefepime, and 500 mg oral metronidazole for 6 weeks postoperatively.

Unstable radius at the 3-month postoperative period led to open reduction using a radial volar plate. Bone grafting was done with femoral intramedullary graft using the reamer-irrigator-aspirator (Depuy Synthes, Warsaw, Ind.) technique. Ulnar nonunion was addressed with bone grafting and small fragment plate. Intraoperative culture was obtained before fixation with a seven-holed plate. Wound was irrigated, closed, and dressed.

Postoperatively, weight-bearing as tolerated was advised for the left lower limb, whereas the left arm remained in an orthoplastic splint. The patient received a 3-month course of oral 500 mg ciprofloxacin based on previous cultures. At 2 months, flexion power improved (3/5 Medical Research Council). At 5 months, an interlocking pin was removed under local anesthesia. At 1 year, complete healing was observed without infection (Figs. 3 and 4).



Fig. 3. A photograph at 1-year follow-up to the hospital with healed soft tissue and a shortened left forearm (used with permission).



Fig. 4. One-year follow-up radiograph of the left forearm with elbow and wrist joint of the patient indicating healed nonunion of radius and ulna with the presence of hard callus and implants (used with permission).

(See Video 1 [online], which shows that the patient is able to do tasks such as buckle and unbuckle his belt and hold his cell phone with his left hand following the forearm shortening surgery.) Occupational therapy was continued. Pain and functional outcomes measured with Disabilities of the Arm, Shoulder, and Hand questionnaire and Patient-reported Outcomes Measurement Information System program scores showed improvement (Table 1). Flexion of the wrist and fingers was preserved. Wrist extension was absent. Functional flexion limb salvage was achieved. Extensor function was not preserved due to loss of infected tissue. Inflammatory markers were normal. Extensor tendons were missing, and the plan is to reconstruct them.

DISCUSSION

Recent data on public health indicate an increase in patients with IVDA history in the United States. During the past decade, there were an estimated 3,694,500 (95% confidence interval, 1,872,700–7,273,300) IV drug users in 2018, representing 1.46% (95% confidence interval,

0.74–2.87) of the adult population.² In our case, the initial open wound, later forearm fracture, and chronic neglect created a progression to soft-tissue infection and eventually contiguous osteomyelitis—a less common but significant morbid progression. Infection from neglect by IVDA is an uncommonly reported phenomenon.

Bone defects measuring up to 6 cm after resection are usually treated by autologous cancellous graft.^{3,4} However, this 7-cm bone defect was accompanied by an equally large soft-tissue defect that would normally require an extensive flap coverage procedure, either with or without vascularized bone grafting. This is one of the first known case reports to document a successful 7-cm acute forearm shortening. Acute limb shortening has been described in the literature for trauma cases with bone and soft-tissue loss; it has helped with the primary repair of the neurovascular tissue, thereby providing tensionless healing.^{5–8} Additionally, shortening is well-tolerated in the upper extremity when compared with the lower extremity.^{9,10}

Reconstructive procedures and bone transport were avoided to prevent prolonged healing and the need for regular follow-ups. These requirements have the potential to be difficult when demanded of a patient with history of negligence, smoking, and IVDA. Hence, debridement, forearm shortening, and soft-tissue closure were addressed in one procedure, and the second surgery addressed the nonunion using a bone graft from the same-side femur (reamer-irrigator-aspirator technique). Bone graft enhanced healing. Responsible behavior avoided toxicology screenings. Tailored care includes wound care, antibiotics, therapy enabled recovery, and even job start as a mechanic. Neglected wounds in IV drug users highlight a need for prompt intervention and forearm shortening aids for noncompliant patients' bone salvage.

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DISCLOSURES

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Table 1. Pre- and Postoperative Comparison of DASH Questionnaire and PROMIS Program Scores

Scoring System	Preoperative	Postoperative (3 mo)	Postoperative (1 y)
DASH	85.8	50	32.5
PROMIS Global 10 Physical Health	8/20 (40%)	10/20 (50%)	14/20 (70%)
PROMIS T-score Physical Health	29.6	34.9	44.9
PROMIS Global 10 Mental Health	6/20 (30%)	9/20 (45%)	17/20 (85%)
PROMIS T-score Mental Health	28.4	36.3	56

DASH, Disabilities of the Arm, Shoulder, and Hand; PROMIS, Patient-reported Outcomes Measurement Information System.

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PATIENT CONSENT

Informed consent was obtained from the patient, who was made aware that data and photographs related to the case would be used for publication purposes.

HELSINKI DECLARATION

The institutional review board determined that this study was exempt from full review. The study conformed to the Declaration of Helsinki.

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