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Case Report

Neglected Infection of Supracondylar Humerus with Non-Prosthetic Peri-Implant Fractures (NPPIF): Case Report

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Abstract

Introduction:
Proximal humerus fractures in adults are one of the most common fractures with an incidence of approximately 6%. However, a non-prosthetic peri-implant fracture combined with neglected infection is still underreported. So far, no journal has been concerned about this topic, and we want to discuss our comprehensive management in this case.

Case Presentation:
A 70-year-old female complained of pain in her right elbow after falling on her house. Fractures got infected after a week of being neglected by the patient. She had a history of open reduction and internal fixation with plate and screws seventeen years ago. She was diagnosed with neglected infection peri-implant fracture right supracondylar humerus Non-prosthetic Peri-Implant Fractures (NPPIF) Classification P1B and scheduled for debridement, removal implant, external fixation with hinged bar. Infection was treated according to the wound culture result.

Conclusion:
Comprehensive management is needed in this kind of case. Our goal in this case is to stabilize the fracture and heal the infection. This patient has a good prognosis and make a functional return.

Introduction

Proximal humerus fractures (PHF) in adults are one of the most common fractures with the incidence approximately 6%.[1] PHFs most commonly occur in patients over 65 years of age.[2] In the setting of osteoporosis or osteopenia, a low-energy fall may result in PHF. Non-prosthetic peri-implant fracture (NPPIF) is a fracture in a bone with an existing non-prosthetic implant such as an extramedullary plate and screws or an intramedullary nail. The term peri prosthesis fracture and peri-implant fracture is overlapped with NPPIF. Since first introduced in 2018, NPPIF is still underreported especially combined with neglected infection.[3] So far, there has not been a journal discussed about this topic and we want to discuss our comprehensive management of neglected infection peri-implant fracture right supracondylar humerus with Non-prosthetic Peri-Implant Fractures (NPPIF) Classification P1B.

Case Report

A 70-year-old female referred from Balimed Hospital Karangasem complained pain in her right elbow after slipping and falling into her house 8 days ago. The patient fell to the right side and used her right elbow as the weight support. Patient had a history of open reduction and internal fixation with a plate and screw seventeen years ago which made her unable to bend and straighten her right elbow even before the accident. History of fever was denied. The patient had



Figure 1. Clinical examination of the patient

no history of other systemic disease. The patient was no longer working and was a right-handed person.

On her right elbow (Figure 1), there was a 1x1 cm wound at the lateral side surrounded with swelling and erythema. From the wound, we could see the pus oozing out but there was not any active bleeding. Deformity and angulation were also seen. When palpated, tenderness was felt around the elbow. The patient was still able to feel sensation and her radial artery was still palpable. However, she could not move her elbow due to pain. Her wrist and metacarpal joints' movement was normal. She was able to extend her thumb and wrist.

Laboratory results showed normal white blood cell 4.56 x $10^3/\mu$L, but a high Erythrocyte sedimentation rate (112mm/hour) and C-reactive protein (31.2 mg/dL). Radiographic examination (Figure 2) showed deformity on the right distal third humerus with plate and screw internal fixation. Placement and apposition were not precise; seemed malunion old fracture.

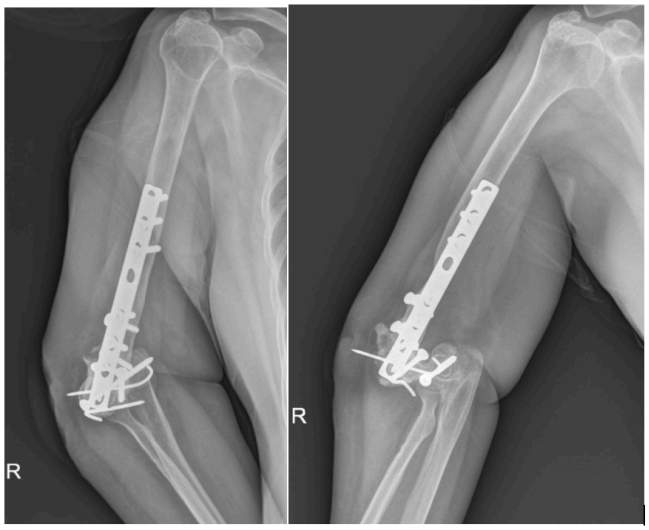


Figure 2. X-ray of humerus anteroposterior and lateral view before the surgery

The patient was diagnosed with neglected infection peri-implant fracture right supracondylar humerus Non-prosthetic Peri-Implant Fractures (NPPIF) Classification P1B and scheduled for debridement, removal implant, external fixation with hinged bar. The incision was made through posterior approach with a triceps fascial tongue approach. Debridement was done including the fibrotic tissue. Cultured was done and showed Methicillin susceptible to Staphylococcus aureus (MSSA). Soft tissue was released and the implant was removed. Fracture was reduced and external fixation with a hinged bar was applied (Figure 3). We did a c-arm to make sure of the position and stabilization. The wound was sutured in each layer. A post-operative x-ray (Figure 4) was done to re-assess the implants.

As operative post-operative management, the patient was given fentanyl 300 mcg 50cc normal saline with the speed of 2,1cc/hour and paracetamol 500mg every 6 hours intra oral. Ceftriaxone 1 g was given twice daily intravenous for 3 days then exchanged for Cefixime 200 mg twice daily intraoral for 5 days. Wound care was done every 3 days. The patient was sent home after being hospitalized for 10 days.

On follow-up; three days after her discharge, the patient only complained of minimal pain (Numerical Rating Scale 3/10). The dressing was dry with minimal seepage. Hypoesthesia still occurred on the dorsum and palmar of the manus. Thumb extension was limited due to pain and the OK sign was positive. A sign of infection was not found. The patient was prescribed with Cefixime 200mg twice daily intraoral and paracetamol 400mg four times a day intraoral. She was then scheduled for another follow-up next week.

Discussion

Non-prosthetic implant per-implant fractures (NPPIF) is a term to call fracture in a bone with a non-prosthetic implant such as an extramedullary plate and screws or an intramedullary nail. The term peri prosthesis fracture and peri-implant fracture is overlapped with NPPIF. A study showed that NPPIF is commonly located in the femur followed by radius/ulna, humerus, tibia, and clavicle. Classification of NPPIF was according to the type of implant (nail or plate), the location of the new fracture (type 1: at the tip, type 2: distant from the implant), and the condition of the original fracture's healing status. Surgical management techniques vary depending on the area. The classification was utilized to determine the appropriate management approaches.[3]

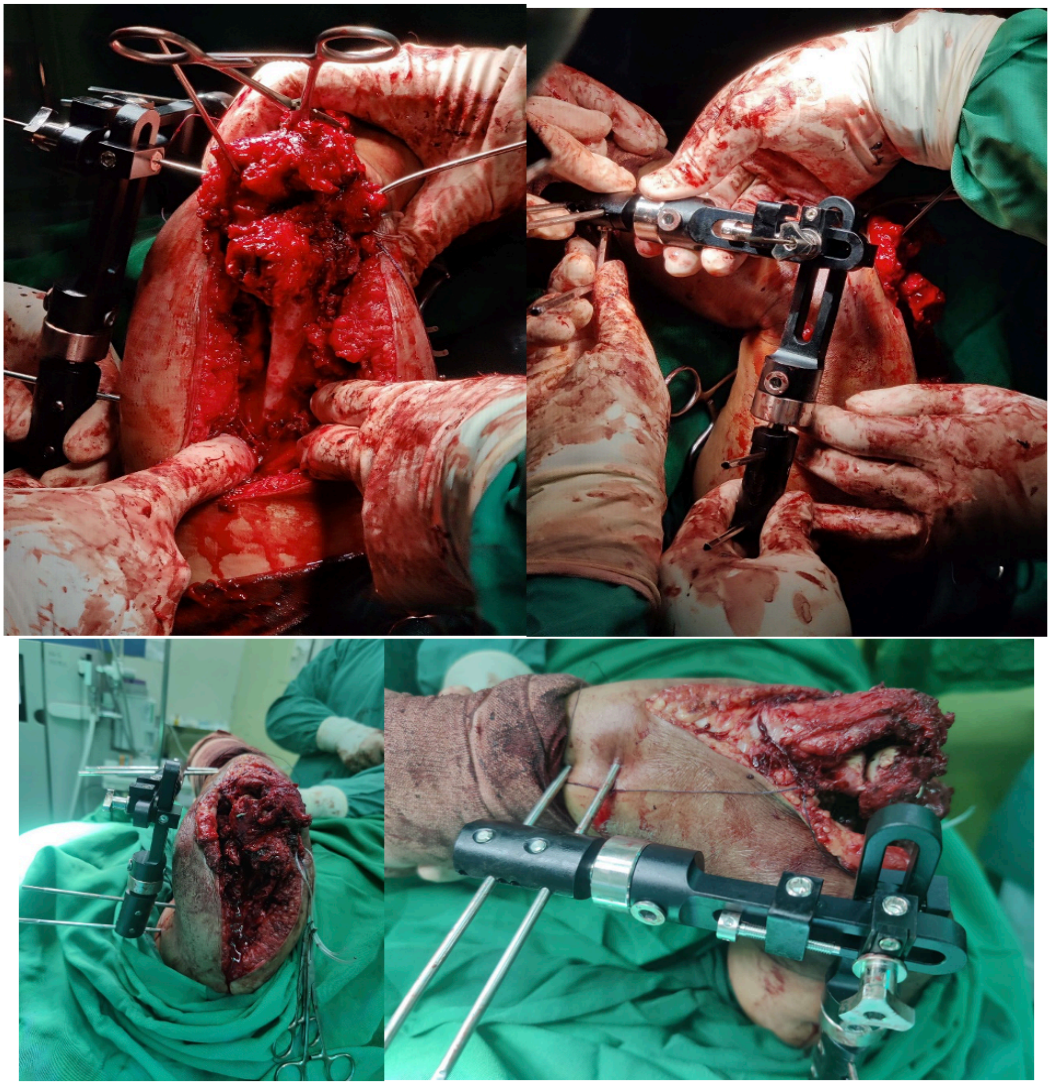


Figure 3. Intraoperative surgery procedure of applying hinged bar external fixation

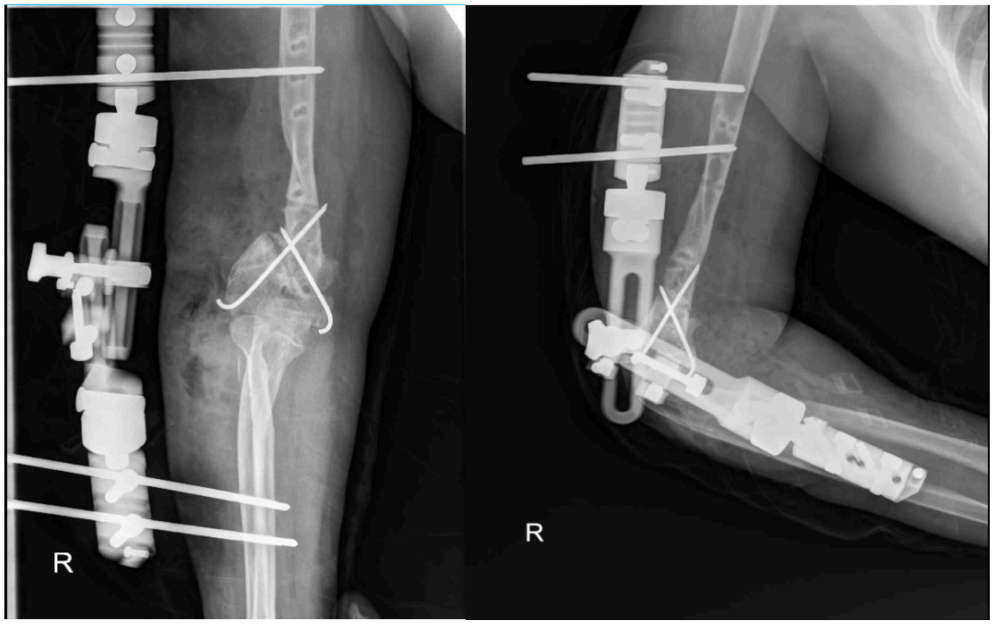


Figure 4. X-ray of humerus anteroposterior and lateral view after the surgery.

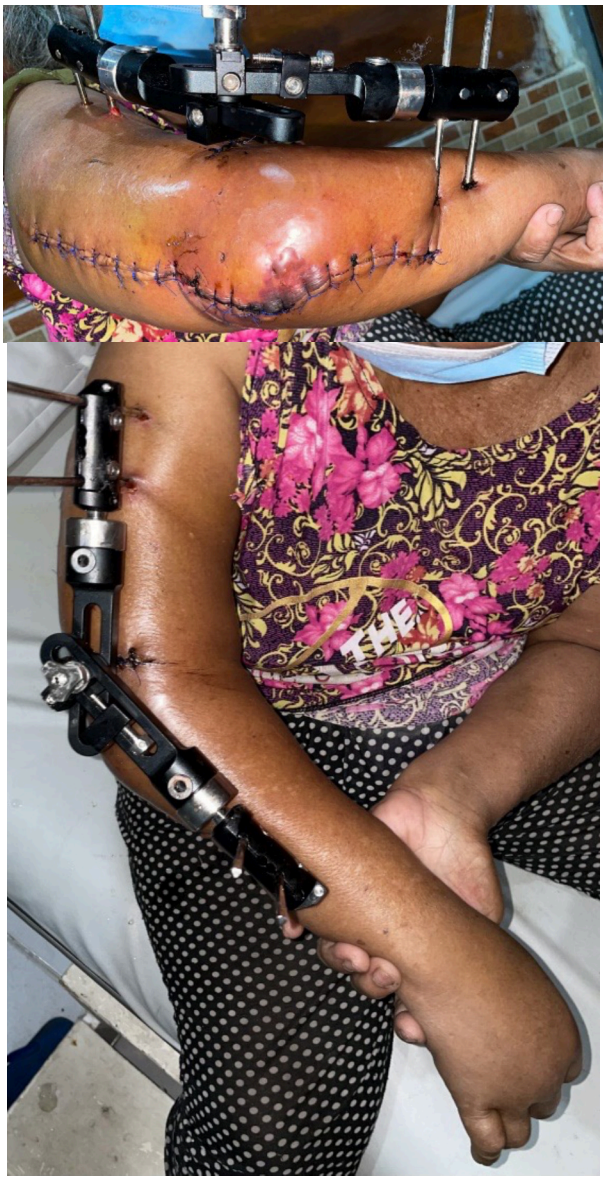


Figure 5. Clinical examination on the first follow-up.

However, this case was complicated by neglected infection in the fracture. Our goal of treatment in this case is to stabilize the fracture and manage the neglected infection due to the fracture. All infections that take place in conjunction with a fracture are now referred to as fracture-related infections (FRI).[4] Damage to soft tissues and compromised blood vessels promote microbial infiltration, which interferes the normal bone healing. Fracture instability causes decreased neovascularization together with continuous osteolysis and soft tissue injury results. This event promotes microbial growth and weakens the host's immune response. Further biomechanical instability results from this cycle. A patient's quality of life may be severely and permanently impacted by FRI because this condition delayed healing, increased functional loss, or amputation. According to recent epidemiological research, the infection rate is 1.8% after closed fractures and 27% after open fractures. FRI also burdens the healthcare system because it costs 6.5 times more than non-infected cases, with a reported 70% treatment success rate, 9% recurrence rate, and 3% amputation rate.[5]

A literature review revealed that certain diagnostic tests (confirmatory criteria) are quite specific for the presence of infection. Leukocyte count, C-reactive protein, and erythrocyte sedimentation rate are examples of common serum inflammatory indicators that have been examined in the diagnosis of FRI. However, these markers can be elevated in many other inflammatory disorders as well as after trauma without infection. After an injury, C-reactive protein (CRP) levels increase, peaking at day 2 and then declining to normal during the following one to two weeks. In this case, CRP was slightly increasing. The other important diagnostic approach of the FRI is microbiological diagnostic. Microbial diagnostic is important to confirm infection, evaluate their patterns of antimicrobial susceptibility, and choose the targeted antimicrobial therapy for the patient. Local antimicrobials should be taken into consideration. After the tissue sample, empiric broad-spectrum antibiotic therapy for FRI should be initiated and then modified as quickly as feasible following culture results. In this case, the patient is still susceptible to methicillin. Therefore, Ceftriaxone is still chosen as the first-line therapy based on our mapping of the hospital microbiome.[5]

The fundamental paradigm for FRI management includes identification of the pathogen, irrigation, debridement, soft tissue management, osseous stability, and tailored antibiotic therapy. Then, the surgeon also needs to decide whether the implant needs to be removed or not based on the healed fracture. Thorough debridement, irrigation with normal saline, fracture stability, dead space control, and sufficient soft tissue coverage are crucial elements of surgical care of FRI. In this case, we had done debridement to remove all the necrotic tissue and also exchanged the implant with hinged bar external fixation.[6]

The original indication of external fixation was for the treatment of open fractures. Today, external fixations are well established for the therapy of chronic disorders such as infected nonunion of fractures, correction of deformity caused by malunion, or management of bone gaps via distraction osteogenesis. External fixations are not only used in acute situations.[7] Hinged bar external fixation was chosen because of several advantages such as stabilizing the joint and enabling early mobilization. Hinged external fixation is usually applied for six to eight weeks. It is also crucial to prevent joint stiffness in elbow disease. By applying a hinged external, it improves the range of motion because it protects elbow protection from valgus and

varus stress and makes the elbow able to bend and extend whereby the ligaments can heal without additional reconstruction.[8] A study showed that using hinged bar external fixation in severe injury of the elbow resulted in the excellent range of motion with the median arcs of flexion-extension and pronation-supination respectively 125° and 170°. The hinged elbow fixator is also used for revision surgery to correct joint incongruency or a stiff elbow as well as for acute therapy of elbow pain.[9]

Conclusion

Comprehensive management is needed in this kind of case. Our goal in this case is stabilize the fracture and heal the infection. This patient has good prognosis and make a functional return.

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