

Diagnosis and rehabilitation of deep wound infection and internal fixation rejection in elbow

A case report

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Abstract

This study aims at diagnosis and rehabilitation of a rare case of deep wound infection and internal fixation rejection in elbow. The patient sustained a distal fracture in the humerus 1 year ago, which was internal fixed. The wound always effused and the elbow had pain and swelling; joint motion was limited. Blood sedimentation rate and C reactive protein level increased, bacterial culture suggested deep wound infection, and ultrasound indicated inflammation. The main diagnoses were deep wound infection and internal fixation rejection. Therapeutics interventions were antibiotic agents, physical therapy, operative debridement, incision, drainage, and exercise and physical therapy. One year later, the internal fixation was taken out. His elbow was fully mobilized and the fracture healed. He got back to his former job. When encountered deep wound infection again and again after internal fixation, rejection should be considered. Except for anti-infection treatment, rehabilitation cannot be neglected, or the healing process may be delayed.

Abbreviation: ESR = erythrocyte sedimentation rate.

Keywords: deep wound infection, foreign body reaction, rejection

1. Introduction

Deep wound infection and foreign body rejection are 2 serious internal fixation complications. The incidences of the complications are 1.9% (closed) /6.2%(open)^[1] and 9.7%(metal)/ 3% (polymer absorbable).^[2] If dealt improperly, they will disturb rehabilitation and bony callus growth, resulting in bad prognoses. There are some clinical manifestations in common.

Local incision red swelling and fever, effusion, pain inside, seriously with general infection. Lab exam shows increased white blood cell counts and erythrocyte sedimentation rate (ESR). X-rays suggest bony callus undergrowth.

There is a peculiar phenomenon: both exist. It is troublesome to analyze, diagnose, and treat the state, which was seldom reported.^[3] We present a case of deep wound infection and fixation rejection in a patient with fracture of distal end of humerus after internal fixation surgery.

2. Presentation

In October 2013, a 23-year-old man presented with an hour history of left elbow pain and limitation of activity following a fall. His left elbow was intensely painful, swelling, deformed, and joint motion limited without injury in other systems (including nerves and blood vessels). X-ray imaging performed in a community hospital revealed a distal comminuted fracture in the humerus. After left upper extremity plaster fixed, he was transferred to the orthopedics department in our hospital. When he was admitted to our hospital, he signed informed consent. The patient was a builder, right handedness, without any abnormal past history.

After hospitalization, 3D CT confirmed the diagnosis (Fig. 1). The patient experienced the operation of olecranon osteotomy, distal humerus open reduction, plate internal fixation in 2 days (Fig. 2). After that, therapy of pain relief and swelling elimination were executed. Ten days post operation, he was transferred to the department of rehabilitation owing to left elbow mobility restriction. Then the left elbow was a little swelling with skin color deep and skin temperature high. The operation incision remained untouched with a little exudation. The elbow was tenderness. The elbow joint range of motion: (flex) 80°, (extend) 20°, (pronation) 40°, (supination) 90°. He was arranged exercise therapy, including continues passive motion (CPM) and muscle power therapy. The dressing of the wound was changed. Also physical therapy (ultraviolet, infrared rays, and pulse magnetic therapy) was exerted on the wound. In addition, medicine was used to subside swelling. Two weeks after operation, the stitches were removed. The effusion was apparently decreasing. Also, the swelling subsided. From then on, joint mobilization and muscle stretching were added to prior exercise therapy. One week later, the symptoms were increasing again. Effusion turned into purulent. His C-reactive protein level was 13.67mg/L and his sedimentation rate was 41mm/h. His blood routine test was

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Figure 1. Comminuted fracture in the humerus.



Figure 2. After operation of olecranon osteotomy, humerus open reduction and plate internal fixation.

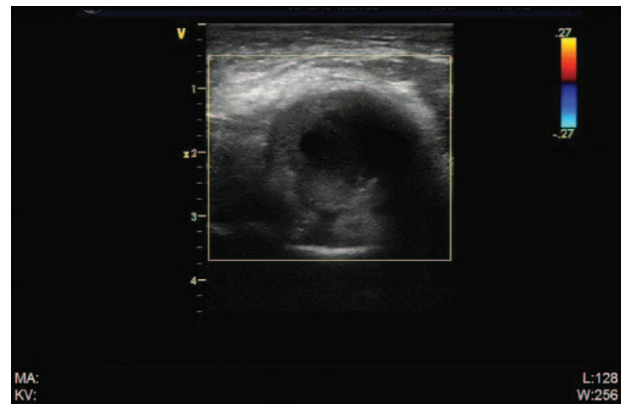


Figure 3. Hydrops in elbow articular cavity with the low-echo area.

normal. The culture grew *Staphylococcus aureus*. His color ultrasound showed: (1) hydrops in elbow articular cavity and fluidity surroundings suggest inflammation and abscess around the fixation; (2) thickened hypodermis around elbow (Fig. 3). The diagnosis was infection inside. He was treated with antibiotic and cold compress. All rehabilitation techniques were ceased including exercise and physical therapy. With the swelling and pain decreasing, effusion reduced, and the wound healed. So rehabilitation was recovered gradually. One month later, the symptoms were increasing again. His C-reactive protein level was 44.48 mg/L and his sedimentation rate was 27 mm/h. His blood routine test was normal. His color ultrasound showed: (1) low level echo encasement around elbow suggests inflammation granulation tissue; (2) high-level echo in surrounding muscles around distal plate suggests calcified myositis; (3) thickened hypodermis around elbow (Fig. 4). The diagnosis was infection again. The therapy was the same as before. When these symptoms diminished, he discharged from hospital. During the following 10 months, similar infection and inflammation appeared repeatedly. Except for medicines, some operations such as debridement, incision, and drainage were exerted. One year after fixation, internal fixation was taken out and these symptoms never happened again. Via systematic rehabilitation, he was fully mobilized and the fracture healed. He got back to his former job.

The study was approved by the Ethics Committee of Fuzhou 2nd Hospital.

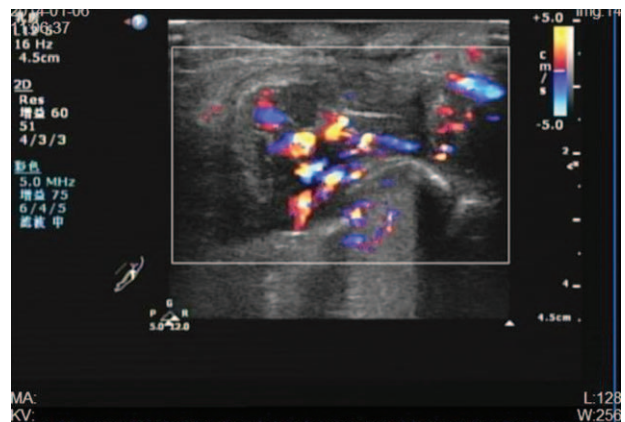


Figure 4. Granulation tissue hyperplasia, abundant blood supply.

3. Discussion

Deep wound infection in the presence of hardware after open reduction and internal fixation is a common complication. *Staphylococcus* spp. are the most common causative organisms of infections.^[4] Although lots of wounds are closed, asepsis demands of surgery are strict and quality of implants is more and more superior, infections happened sometimes. The implant relevant infection may caused by micro-organism growing in biomembrane. Pathogens adhere to the surface of implants at the beginning, then gather to form biomembrane.^[5] Free active micro-organism is sensitive to antibiotics and the defense mechanism (antibody and macrophages) of host. Although pathogens living in biomembrane is tolerant to those factors due to protection of biomembrane,^[6] exhaustion of metabolite and accumulation of waste in biomembrane make pathogens delaying growth even entering the silence period. Compared with the active phase, the endurance of pathogens to antibiotics increased 1000 times.^[7] So the existence of fixation make patient susceptible to infection. If the situation cannot be dealt properly, fracture would not be union, even developing to osteomyelitis. Therefore, treatment in early stage is especially important. It was reported that most patients (71%) with postoperative infection within 6 weeks had fracture union after operative debridement, retention of hardware, and culture-specific antibiotic treatment and suppression, whereas predictors of treatment failure were open fracture and the presence of an intramedullary nail.^[8]

Rejection is another common complication following internal fixation. As a kind of biological response, it is caused by the tissue injury that results from implantation of the device as well as the continual presence of the device in the body, including the inflammatory reaction and the foreign body reaction. The main stages in inflammation process include acute inflammation, chronic inflammation, and the formation of granulomatous tissue.^[9] The acute inflammation phase is responsible for provisional matrix formation and cleaning of the wound site.^[10] The chronic inflammation phase is generally characterized by the presence of macrophages, monocytes, as well as the proliferation of blood vessels and connective tissue to restructure the affected area.^[11] The foreign body reaction is induced by implantation. The degree of this reaction depends on the properties of the device. Metallic implant belongs to biologically inactive materials. Compared with metallic implant, biomaterial implant has a higher incidence of foreign body reaction.^[12] As to rejection, the only thorough solution is unloading internal fixation. Although fixation exerts important function, it should be remained in body. To suppress inflammation, anti-inflammation agents can be applied, such as steroid or nonsteroid anti-inflammation drugs,^[13] or biocompatible “coat” around implant.^[14] In addition to suppressing the inflammatory reaction, improving properties of implant material, suppressing fibrosis and calcification, as well as facilitating neoangiogenesis can eliminate the foreign body reaction.^[9] Improvement of biomaterials has become a “hot” point in the area of orthopedics and biomaterials.

From the case, deep wound infection was diagnosed by clinical syndromes, laboratory examination, and imaging examination. He was treated with many programs including antibiotic agents, physical therapy, operative debridement, incision, and drainage. Local infections were eradicated just after the fixation removed. It is rare in rehabilitation clinic. So we should consider the necessary relation between repeated infections and implant. The mecha-

nism of repeated infections induced by rejection may be as following: the foreign body reaction in the local area around implant due to fixation forms effusion and granuloma. Inflammation and hydrops provide suitable circumstance for growth of bacteria, resulting in infection.^[15,16]

To identify local pathological changes, high frequency colorful ultrasound is suggested. It can clearly image inflammation, granulation tissue, and calcification. When compared with traumatic methods such as puncture and incision, it is noninvasive. When compared with other imaging techniques (radiography, computer tomography, and magnetic resonance imaging), ultrasound offers numerous advantages. It offers a hands-on, dynamic, 3-dimensional, convenient, cheap examination, without radiation. It can also be used to guide percutaneous interventions. It is emerging as a powerful diagnostic and clinical decision-making tool in the musculoskeletal system for physicians.^[17]

How can we effectively control repeated infections induced by rejection without influencing union of fracture and recovering maximum function. To the troublesome situation, we need to deal with infections. Should implant be removed? It was reported that most deep infection after internal fixation of a fracture can be treated successfully with operative debridement, antibiotic suppression, and retention of hardware until fracture union occurs. Just very few implants should be removed only under the conditions of severe, broad, uncontrollable infections. The case is special. Though repeated infections delayed fracture healing and rehabilitation process, the implant was removed till fracture fast union occurs in case the bone lost stabilization leading to uncontrollable infection.^[18] During the stage of implant retention, we terminated rehabilitation except cold treatment when infections appeared and kept active rehabilitation when infections disappeared. So the patient’s joint range of motion and muscle power were kept in favorable condition, avoiding some complications disadvantage to function such as joint contracture.

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