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Treatment Strategies for Acute Open Logsplitter Injury with High Risk of Infection: A Case Report

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Case Report

A 20-year-old male was admitted to the hospital with a chief complaint of ' The car accident caused the left ankle swelling and pain, limited activity for more than 1 hour '. During physical examination, a 6cm irregular transverse wound was seen in the patient 's left medial malleolus, with visible distal tibial leakage and marked bleeding, his left foot valgus deformity, limited flexion and dorsiflexion, left plantar sensation weakened (Figure 1 A). The past history, personal history, family history and marital history are normal. After admission, his blood, ECG and chest X-ray examination were normal, but the left ankle X-ray examination was abnormal, which suggested destruction of anatomical relationship between lower tibiofibular syndesmosis and ankle joint (Figure 1 B, C). Based on these information, he was diagnosed as Acute Openness Logsplitter Injury.

After evaluation, traumatic orthopedic surgeons decided to perform an emergency surgery under combined spinal-epidural anesthesia. Firstly, made a debridement, removed the inactivated tissue, stopped bleeding, and used hollow screws to fix the reduced tibiotalar joint and medial malleolus. Secondly, used cortical bone screws to fix the anterolateral avulsion bone of the tibia, reset the fibula fracture end and used plate screws for fixation. And then, used two cortical bone screws to fix the lower tibiofibular syndesmosis. Finally, used two Kirschner wires enter the needle from the sole of the foot to fix tibia, talus and the

calcaneus. The ankle joint after reduction and internal fixation was observed by ' C ' arm X-ray machine (Figure 2). Then rinsed the wound, and implanted an antibiotics-loaded bone cement into the anterolateral ankle and medial tibial spaces. Finally, sutured layer by layer, filled the negative pressure drainage sponge, covered the excipients and ended the operation.

A common antibiotic was used to prevent infection 24 hours after operation, oral drugs were used to relieve swelling and pain. The 3D-CT (Figure 3) and X-ray (Figure 4 A,B) of left ankle joint were reviewed on the first day after operation. On the 7th day, removed the drainage equipment because drainage volume was less than 15ml. At the 4th week, the wound reached grade I healing, so the sutures were removed, and he was told to avoid excessive weight-bearing. Three months after operation, Kirschner wire, inferior tibiofibular screw and antibiotic bone cement were removed, and reviewed the imaging data (Figure 4 C,D). After 1 year follow-up, he regained weight-bearing walking and was satisfied with the treatment effect. The man reexamined an anterior-posterior and lateral X-ray (Figure 4 E, F). Ankle dorsiflexion range up to 15°, plantar flexion ranges up to 30°. The AOFAS Score was 85 and the Kellgren-Lawrence Classification was I.

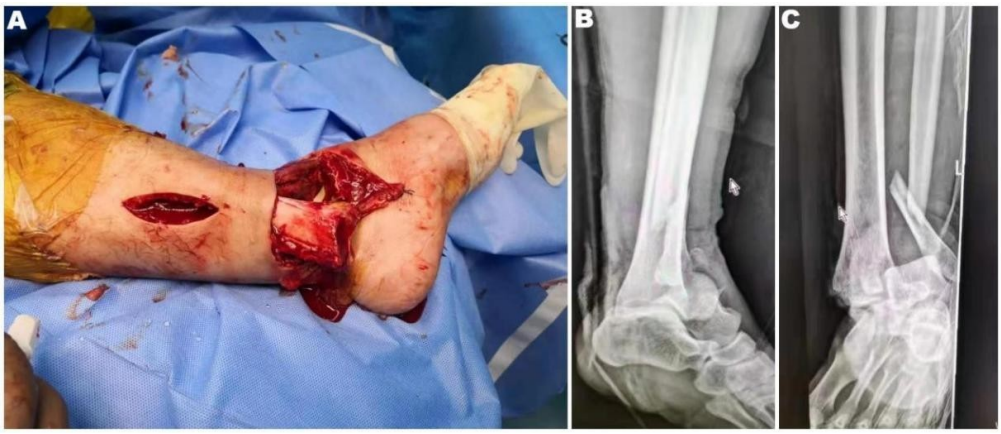

Figure 1: Photos before surgery

(Note: A 20-year-old male was diagnosed as Acute Openness Logsplitter Injury, Gustilo type IIIA, who was hit by a car at 15:10 on December 15,2020. Figure. A showed a longitudinal open wound of about 3cm in the medial side of the left leg and an irregular transverse open wound of about 6cm in the medial malleolus, with visible exposure of the distal tibia and apparent oozing of blood around it. Figure. B was anterior-posterior X-ray, which showed that the bone of the lower part of the left fibula was interrupted and displaced. The distal end of the left fibula fracture was detached from the talus joint and displaced laterally. The distal end of the left tibia was detached from the tibiotalar joint and displaced anteriorly, inferiorly and medially. The talus was embedded in the lower tibiofibular syndesmosis, and the lower tibiofibular syndesmosis was obviously separated. Figure. C was lateral X-ray, which showed that the lower end of the left tibia was displaced backwards, and the bone at the lower end of the left fibula was broken at about 3 cm, and an oblique fracture line was seen. The distal end of the lower tibiofibular syndesmosis was displaced backwards and crossed the top of the talus. Completely out of the ankle hole.)

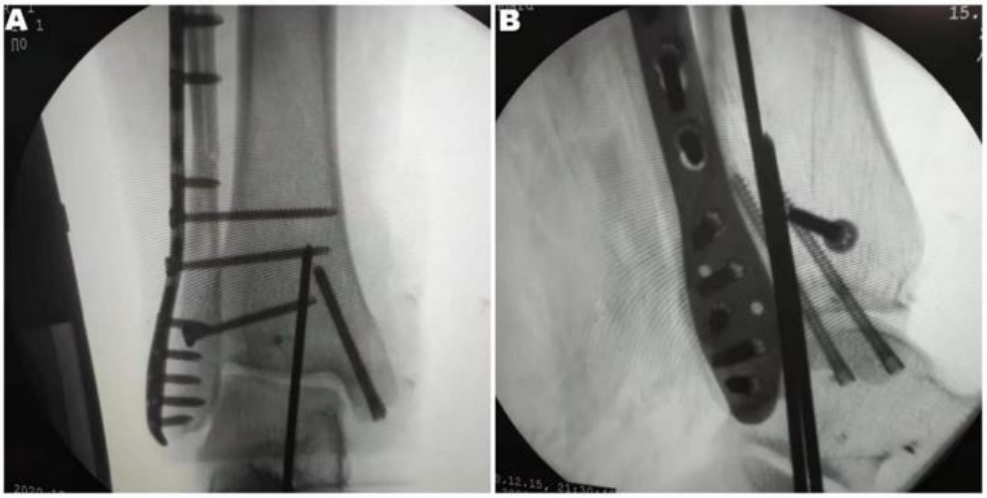

Figure 2: Intraoperative imaging

(Note: Figure.A was positive tablet X-ray and Figure.B was lateral tablet X-ray, which showed that the medial and lateral space of the left ankle joint was equal, the internal fixation position and fracture alignment was good, and the screw length was suitable.)

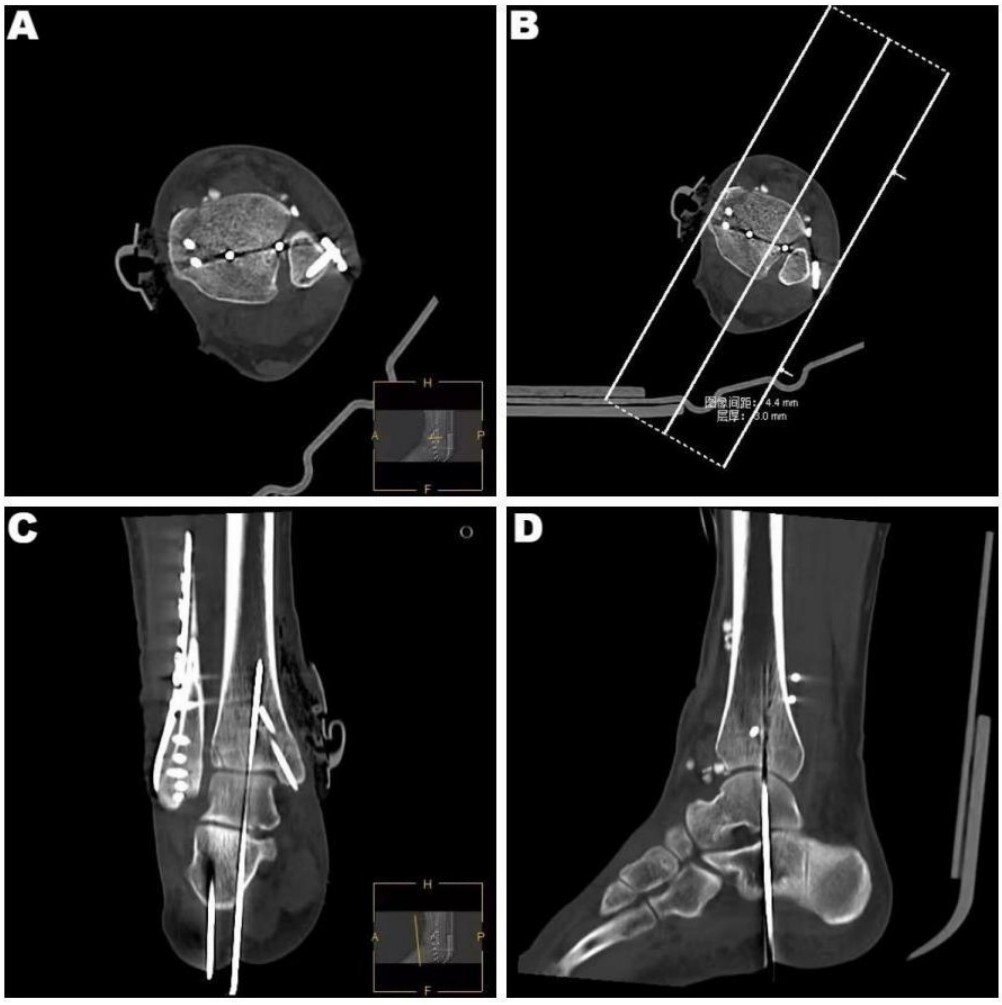

Figure 3: Three-dimensional CT imaging of ankle joint on the 1th day after operation

(Note: Figure. A and B were cross section, showing satisfactory lower tibial fracture screw fixation position; Figure. C was coronal position that revealed a good tibial joint reduction, satisfactory heel, talus and tibia needle fixation and good joint clearance coronal surface, smooth

tibial joint and heel plane, clear clearance, satisfactory fibula LCP fixed position; Figure. D was sagittal position showed that smooth tibial joint and heel plane, clear clearance, satisfactory fibula LCP fixed position)

Figure 4: Postoperative imaging

(Note: Figure. A and B were taken on the 1th day after operation, Figure. C and D were taken on the 3th month after operation, and Figure. E and F were taken 1th year after operation. Figure. A was taken in the positive position and B in the lateral position showed that the fracture and dislocation of the left ankle have been corrected, no significant widening of the lower tibial joint space, and the arrow indicates bead-like antibiotic cement. Antibiotic bone cement was made of 40g bone cement and 1.5g vancomycin. After adding water, it would be completely hardened after several minutes, so it should be used before hardening. Figure. C was the anterior-posterior X-ray and D was the lateral X-ray, which indicated that had good alignment, smooth joint surface, satisfactory tibiofibular joint location. Figure.was positive and F was lateral tablet, that there was satisfactory tibial joint reduction, fibular fracture healing, clear and smooth ankle gap.)

Discussion

Recently, a special disease called logsplitter injury has been increasing, which has attracted the attention of trauma surgeons, but there is no clear treatment consensus [1]. Therefore, this article shares a typical and challenging case. When vertical violence acted on the distal tibiofibular syndesmosis, tibial articular surface and distal fibula and was absorbed by them and converted into transverse traction force, causing ankle fracture combined with talus dislocation to be embedded upward into the distal tibiofibular syndesmosis, resulting in the separation of the distal tibiofibular syndesmosis. There was no doubt that a definite diagnosis could be made based on the history of trauma and typical imaging features [2]. Obviously, there were some open wounds on his left ankle, the bacteria were prone to invade, leading to a high risk of infection so that he was diagnosed as Gustilo type IIIB.

Wang Yong et al [3] have suggested that the key treatment strategy for Logsplitter injury refers to achieve anatomical reduction of the lower tibiofibular syndesmosis through open reduction and internal fixation (ORIF), and ultimately restore the biomechanics of the ankle joint. According to the condition of injury, choose an appropriate operation time, reset anatomical structure, protect the soft tissue and make some reliable fixations are the key points which can obtain satisfactory curative effect. Therefore, ORIF should be performed as soon as possible for those patients who are diagnosed with closed or Gustilo type I Logsplitter injury. But for Gustilo II and IIIA injuries, on the basis of complete debridement, seek the anatomical reduction, use plate screws and cannulated screw to fix, and try to repair the ankle around the damaged ligaments and joint capsule. Gustilo type IIIB and IIIC injuries should be thoroughly debrided in the first stage, make the reduction of the fracture during surgery and use some Kirschner wires to fix. The external fixator or plaster also can be used for temporary fixation. The wound is advised to make tightly drained with adequate negative pressure. And then the second stage skin grafting or flap transfer should be performed.

Therefore, he was treated with ORIF, full debridement at stage I, and antibiotic bone cement combined with vacuum sealing drainage (VSD) to avoid common complications such as postoperative infection and traumatic arthritis. Some scholars [4] believe that antibiotic bone cement combined with VSD are helpful in the treatment of open fractures that have a risk of infection. Continuous negative pressure suction can make local bone cement accelerate the release of antibiotics, so as to discharge the lesion exudate, pus and necrotic tissue in time, which are conducive to the formation of granulation tissue. It also has a certain protective effect on tendon and cartilage, and produces an induced membrane for bone tissue protection stimulation [5], while reducing the use of systemic antibiotics. Professor Xirui Wu, a Chinese orthopedic trauma specialist, uses vancomycin combined with gentamicin-containing antibiotic bone cement and periosteal induction to treat patients with osteomyelitis, bone defects and complex infected wounds. Its effect and advantages have been affirmed.

Obviously, these treatment measures taken by the case during the perioperative period are effective. It provides a reference for the treatment and is worthy of clinical promotion. It is hoped that can inspire trauma surgeons and improve their understanding of logsplitter injury. However, large sample and multi-center related research work should be carried out in the future to further prove the advantages and potential risks of antibiotic bone cement.

Author contributions

(1) Concept or design: Y.T. Cai. (2) Acquisition of data: T.Q. Zheng. (3) Analysis or interpretation of data: Y.T. Cai, T.Q. Zheng. (4) Drafting of the article: R.Z. Huang. (5) Critical revision for important intellectual content: Y.T. Cai. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

There are not any conflicts of interest in the past 3 years, all authors have disclosed no conflicts of interest.

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