CASE REPORT

Tibiotalocalcaneal Arthrodesis Following a 20-year-neglected Retained Bullet Foreign Body Removal in Ankle Joint: A Case Report

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Abstract

Aims and background: A bullet foreign body, especially if embedded in joint space, can cause multiple complications. Although there is still no standard treatment for retained bullet foreign bodies, we found in some literature that bullet removal is the best treatment option for intra-articular involvement. Achieving ankle stability is considered a priority after foreign body removal.

Case description: We present a 48-year-old male with swelling and pain in his right ankle after falling from a parked motorcycle. The drop-foot gait pattern was also found. We later found from an X-ray examination that the patient had an untreated bullet foreign body embedded in his right ankle from an incident 20 years ago. Foreign body removal and tibiotalocalcaneal arthrodesis (TTCA) using retrograde intramedullary nail were performed to achieve ankle stability.

Conclusion: Tibiotalocalcaneal arthrodesis (TTCA) using retrograde intramedullary nail performed in this particular case showed good clinical outcomes and a good return-to-work rate.

Clinical significance: This case report revealed that bullet removal in the tibiotalar joint is a great treatment option for patients experiencing abnormal gait pattern and chronic pain. The utilization of retrograde intramedullary nail along with bone graft can be a promising option in cases with avascular necrosis of the talus to achieve a stable ankle fusion.

Keywords: Bullet foreign body, Case report, Retrograde intramedullary nail, Tibiotalocalcaneal arthrodesis.

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Introduction

Bullet foreign body involving joint spaces is a rare case and may cause many complications.[1] Complications that could happen are either local reactions or systemic reactions.[1–3] Symptoms of local reactions of bullets in joint spaces are arthropathy, soft tissue damage, infection, and bone damage. Meanwhile, systemic complications are caused by the absorption of bullet material into the vascular system.[1,2]

Removal of a bullet embedded in the ankle joint is likely the best choice of treatment. In addition, it is essential and recommended to remove bullets located in the tibiotalar dan subtalar intra-articular spaces.[4] High risk of infection, inadequate soft tissue coverage, and long-term complications, such as chronic pain, become the main consideration to choose bullet removal as a definitive treatment option.[4,5]

Tibiotalocalcaneal arthrodesis (TTCA) is one of the treatment options for various ankle and hindfoot conditions. Some conditions that may be treated with arthrodesis are posttraumatic arthrosis, avascular necrosis, posterior tibial dysfunction, rheumatoid arthritis, deformity, failed total ankle replacement salvage, or one that suffered serious complications.[6] In many cases, TTCA is proven to significantly reduce or even completely heal pain, restore gait pattern close to normal, and reduce the risk of amputation in some severe cases.[6,7] Methods of arthrodesis vary widely. Plates, screws, intramedullary implants, and external fixations may be used to perform arthrodesis.[6,8] However, the definitive choice is still a controversy, and the technique used is still according to surgeons' preferences.[8,9]

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Case Description

A 48-year-old male came to orthopedic outpatient department with chief complaints of pain and swelling in his right ankle that had recurrently happened for a long time. It was getting aggravated after he fell from a parked motorcycle and got hit on the exact foot 3 days before admission. This condition made it difficult for the patient to walk normally. The patient admitted that he had no prior medical conditions. After some deeper history taking, the patient admitted that he was shot by a lead bullet shotgun in his right foot while hunting in the woods 20 years ago. Since that incident, the

patient felt his ankle often got swollen and in mild pain, but he never met a doctor or any healthcare facility. The patient just did a homecare treatment on his own.

Upon clinical examination, we found redness and soreness of the affected foot. We found no wounds from the site of injury. There was pain on palpation of his right ankle along with limited passive and active ankle ranges of motion. From gait observation, we found the patient experiencing a drop-foot gait pattern.

Based on preoperative radiographic examination, it revealed a foreign body retained in the tibiotalar joint spaces with many smaller fragments spread over the ankle region. We also found some calcification and cortex irregularity of the distal tibia indicating an arthritic condition coexisted with the destruction of the body of the talus caused by foreign body implantation.

After the surgery had been taken, the patient used two crutches and was nonweight bearing. His affected ankle was also put on a boot slab for 1 week. The patient was admitted to inpatient care for 3 days postoperatively and was administered intravenous antibiotics and a passive drain into the surgical area. At the first post-op visit, 1 week after surgery, there was slight edema and erythema at the surgical site. The patient was then prescribed oral steroids for three days and oral antibiotics for five days. In the second after surgery, the surgical incisions did not show any signs of infection but there was still edema found. We removed the stitches in this 2nd week post-op. The patient also started partial weight-bearing and routine physiotherapy program. In the fourth week, the patient routinely underwent transcutaneous electrical nerve stimulation (TENS) and range of motion (ROM) exercise. We also evaluated the patient's ambulatory/walking status in our medical rehabilitation unit. In the 8th week, the patient started using one crutch and gradual weight-bearing as tolerated. The patient could tolerate the physiotherapy program and ambulatory transition very well without any considerable complaints. In the fourteenth week, we did an X-ray evaluation and started nonweight-bearing on the patient. The patient could tolerate nonweight-bearing status very well without any concerning pain. The patient also achieved good stability and a well-maintained plantigrade position. In the eighth month after surgery, we did a routine X-ray evaluation and found a good joint union without any serious complications.

Surgical Technique

The patient was placed in the supine position under spinal anesthesia. A thigh tourniquet was placed with a pressure of 350 mm Hg. An aseptic manner was undergone before the incision. An approximately 5 cm linear incision was made on the anterior aspect of the patient's ankle exposing tibiotalar joint space. From the surgical site, we found severe ankle arthritis with osteophyte formation. We found the largest fragment of a bullet embedded in tibiotalar joint space. Every bullet fragment visualized was then removed. We extracted three fragments out of the surgical area, with lengths of 1.7, 1, and 0.5 cm, respectively. After bullet extraction was done, we evaluated the talus and found it in severe avascular necrosis condition. The necrotic tissues were removed through curettage, and the cartilage of talus and tibia was resected until we saw the bleeding. A concerning defect was visualized after the resection was finished. After the resection, we covered the ankle area with a sterile drape. Then, we made an incision just below the heel to expose the calcaneus. After the calcaneus was exposed, we inserted the guide wire through the tibia using the C-arm as the radiological guidance. The reaming procedure was done sequentially until we reached 11 mm in size. A nail, in size 10 mm in diameter and 260 mm in length, was then inserted retrogradely. The insertion of screws was done with the foot maintained in a plantigrade position. There were three distal screws inserted, one screw in the distal tibia, and two cross screws in the calcaneus. Then, there was one screw inserted proximally into tibial shaft. The defect area of the talus was closed using a synthetic bone graft. The area of surgery was sterilized using normal saline and then stitched in layered fashion. Then, we applied boot slab to the affected foot (Figs 1 to 3).

Discussion

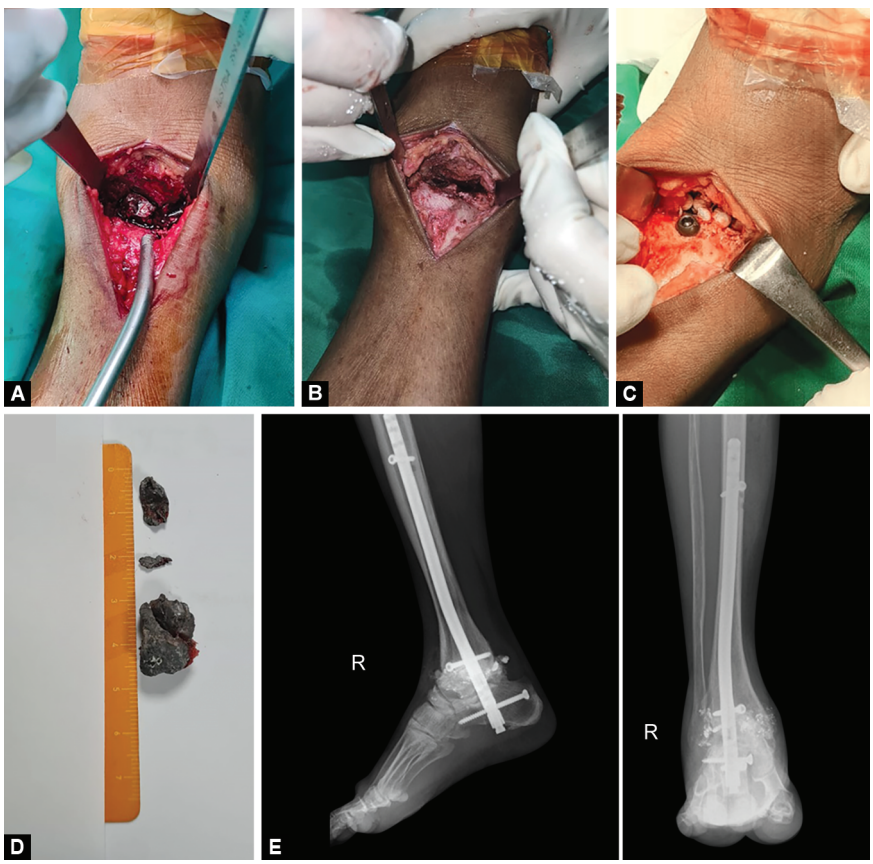
It was mentioned that some cases with bullet foreign bodies with none to minimum pathology may be managed conservatively.[3,10] However, in another literature, a bullet foreign body involving intra-articular spaces, though having no pathology, may cause long-term tissue damage that can cause total joint replacement to become necessary.[5] Baum et al. clearly defined some recommendations of options in considering the management of choice. Conservative management may be considered if there a little or no bullet fragments retained, the damage to soft tissue is minimal, and the bone damage is outside the primary location of bullet penetration. Meanwhile, operative management may be considered if there is concerning tissue damage, vascular damage, progressive neurologic deficits, severe contamination, joint involvement, tendon damage, compartment syndrome, unstable fracture, involving palm, and the onset is <8 hours.[4] In addition, it is also recommended to remove the bullet if there is weight-bearing part of foot sole involvement.[11–13]

Tibiotalocalcaneal arthrodesis (TTCA) is a procedure combining ankle and subtalar arthrodesis which passes the calcaneus, talus, and tibia.[7] This technique has many purposes, such as to relieve pain caused by severe arthritic joints, to restore gait patterns, and to fix deformities.[7,8] There are many methods to perform TTCA, including the use of screws, plates, nails, and external fixation.[6] However, the principles remain the same. They are removing cartilage until subchondral bleeding is present and putting the joint surfaces for the fusion in a good position to achieve a stable ankle.[7]

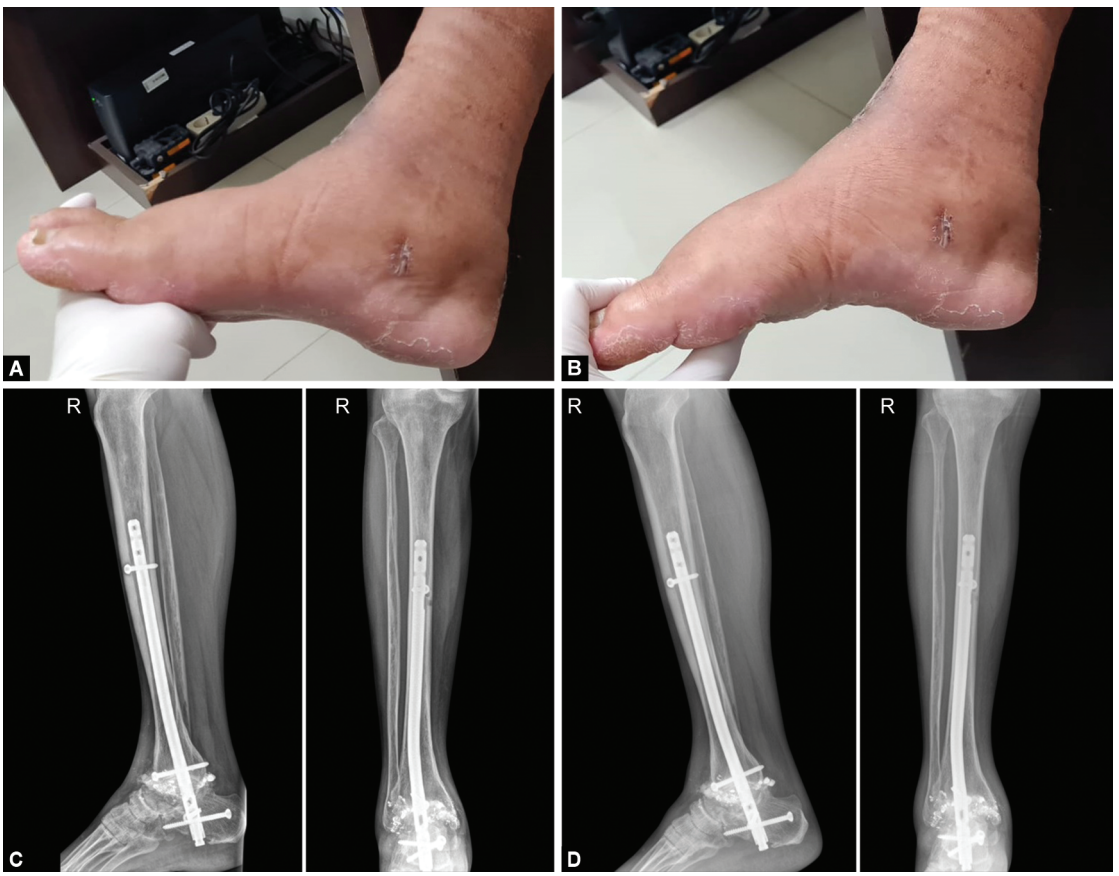
One of the challenges of doing a tibiotalocalcaneal procedure is avascular necrosis of the talus.[14] This condition may increase the risk of nonunion to 29–32%. The alternative that can be done to increase the union rate is to use bone graft along with a well-positioned arthrodesis. The keys to success in the TTCA procedure are the complete resection of the necrotic part of the bone, the addition of allograft or autograft to close the defect and for incorporation, and using the hardware with good compression and alignment.[13]

Retrograde intramedullary nailing is one technique option to perform TTCA.[14] This technique itself, according to some literature, is considered superior. This technique uses a minimally invasive method so the infection rate is lower. Moreover, this technique has a better union rate and stability compared to the others.[8] Based on Mendicino et al., retrograde intramedullary nailing has union rate reaching 95% in 20 cases.[15] The utilization of retrograde intramedullary nail is significantly more stable based on bending tests in plantarflexion, dorsiflexion, inversion, and eversion, as well as internal and external rotation. This is very helpful to achieve adequate joint union.[15] Both longer and shorter nails can be used in this method. Nevertheless, longer nails have superiority over shorter ones. It can lower the risk of stress fracture of the tibia, and improve stability and torsional

Figs 1A and B: (A) Preoperative clinical conditions; (B) Plain preoperative radiographs showing a bullet embedded in ankle joint



Figs 2A to E: (A) The bullet was embedded in the tibiotalar joint along with arthritic joint and necrotic of the talus appearances; (B) Tibiotalar joint condition after bullet removal and curettage showed some defects; (C) The use of synthetic bone grafts to close the defect in the joint spaces; (D) Extracted bullet fragments; (E) Plain radiographic evaluation after surgery



Figs 3A to D: Clinical condition 14 weeks after surgery showed a stable plantigrade position without signs of infection, showing (A) Maximum dorsiflexion; (B) Maximum plantarflexion; (C) Plain radiographic evaluation 14 weeks after surgery; (D) Plain radiographic evaluation 8 months after surgery

strength compared to the shorter one.[9,14] Based on Quill, 90% of 40 patients treated using the retrograde intramedullary nail method showed the mean time of bone healing at 14 weeks.[16] The main objectives of this treatment option are achieving good stability, plantigrade ankle, and tolerable or relieved pain.[7] However, some complications may happen, including infection caused by the implants, failure of implants, stress fracture, soft tissue infection, and delayed union or nonunion.[14]

This case report revealed a specific treatment in a patient with a bullet foreign body and the condition was worsened by a recent trauma to the patient's ankle. The patient showed chronic pain and swelling ankle on admission. Another symptom that indicated the patient should undergo the surgery was a drop-foot gait pattern. This patient underwent bullet removal, followed by TTCA using retrograde intramedullary nail technique and utilizing a longer nail. Then, synthetic bone graft was applied to close the defect caused by avascular necrosis of the talus. This patient showed no serious complications throughout the postoperative follow-ups and could walk without any walking devices in the 14th week.

A limitation of this report is that it is a single-patient report. Another limitation is that we did not use any quantitative methods of evaluation, such as pain scoring, patient satisfaction scoring, or functional limitation scoring. We evaluated only through the patient's subjective complaints and clinical or radiographic examination.

Conclusion

Tibiotalocalcaneal arthrodesis (TTCA) using retrograde intramedullary nail performed in this particular case showed good clinical outcome and good return-to-work rate

Clinical Significance

This case report revealed that bullet removal in the tibiotalar joint is a great treatment option for patients experiencing abnormal gait pattern and chronic pain. The utilization of retrograde intramedullary nail along with bone graft can be a promising option in cases with avascular necrosis of the talus to achieve a stable ankle fusion.

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