CASE REPORT

Tibiotalocalcaneal Arthrodesis Using Femoral Head Allograft in a Case of Traumatic Bone Loss of the Talus

Bing Wui Ng[1], Mohd. Yazid Bajuri[2]

[1] Hospital Pakar Kanak-Kanak UKM, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia.
[2] Department of Orthopaedics and Traumatology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia.

ABSTRACT

Bony reconstruction during tibiotalocalcaneal arthrodesis in the face of large bony defects remains a challenging procedure. These large bony defects could be caused by avascular necrosis of the talus, trauma, failed total ankle replacement, osteomyelitis, Charcot arthropathy, tumours of the talar body or failed reconstructive surgery (1). Previous studies have shown that treating body defects of the talus with tibiocalcaneal fusion could result in significant limb length discrepancy, ankle instability and chronic pain (2). The use of bulk femoral head allograft in tibiotalocalcaneal fusion can reconstruct the height of the ankle and at the same time provide a good bed for fusion to occur (3). We report a case of traumatic bone loss of the talus in which a tibiotalocalcaneal arthrodesis was done using bulk femoral head allograft.

Keywords: Tibiotalocalcaneal arthrodesis, Talus, Traumatic bone loss, Femoral head, Allograft

Corresponding Author:
Mohd. Yazid Bajuri, Ms Ortho
Email: ezeds007@yahoo.com
Tel: +60172771000

INTRODUCTION

Large bony defects of the talus present a challenging reconstructive dilemma for foot and ankle surgeons. These large bony defects could be caused by direct trauma to the talus and other pathologies such as infection, Charcot arthropathy and tumour of the talar body. Patients could with these bony defects acutely after trauma or a more insidious onset of pain in the cases of infection, Charcot arthropathy or tumour. Diagnosis could be made with careful clinical examination and interpretation of the ankle radiograph. Literature has described the use of tibiocalcaneal fusion in treating these large body defects. This technique has been reported to have an excellent fusion rate however complications have been noted such as significant lower limb shortening, contractures of the muscles and disbalance of the soft tissues and tendons around the ankle joint (2,3). The advantages of restoration of limb length include better soft tissue tension leading to preservation of muscular and tendinous function. The use of bulk femoral head bone graft could provide the height restoration needed between the tibia and calcaneum in the condition of talar defects. We present a case of a patient who suffered from traumatic bone loss of talus which a tibiotalocalcaneal fusion using a bulk femoral head allograft was done.

CASE REPORT

A 48-years old man who was involved in a motor vehicle accident was admitted to our centre with complaints of pain over his left foot and a bleeding wound on the medial aspect of his left ankle. On examination, there was a contaminated wound measuring 3cm x 3cm over the left medial malleolus with bone exposed. Diffuse swelling was noted over the left ankle. Distal pulses of the left foot were palpable and capillary refill time was less than two seconds. After reviewing the radiographic investigations, diagnosis of open fracture of the left medial malleolus, closed fracture

of left calcaneum, closed fracture of 5th metatarsal bone and closed comminuted fracture of left talus was made. A two-stage surgery was planned for this patient to address the significant talus bone loss. The patient has first undergone wound debridement and cross ankle external fixation (Figure 1). Intraoperatively, the ankle was subluxated with a complete tear of the left deltoid ligament and bone loss of the talus body.

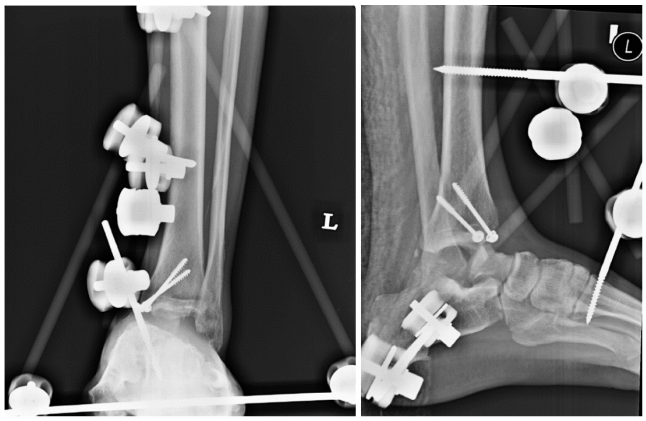

Figure 1 : Anterior-posterior and lateral view radiographs of patient's left ankle after cross ankle fixation showing bone loss of the talus.

A second surgery was done 2 months later when the soft tissue condition has improved. Talectomy, bone grafting using bulk femoral head allograft and tibiotalocalcaneal fusion was done.

Surgical technique

The tibiotalocalcaneal arthrodesis surgery was done under general anaesthesia. The patient was placed in a supine position with a bolster under the left hip. A lateral incision was made over the left ankle and the fibula osteotomized around 10 cm from the ankle joint and removed. The deformed talus was excised and measured (Figure 2a). A distraction force was applied to reestablish near-normal hindfoot height with the left foot in a neutral position in all planes. The hindfoot and ankle were then positioned in neutral dorsiflexion and slight valgus. Excessive tension is avoided to prevent tissue breakdown and overlengthening of the ankle joint. The defect size was measured and surfaces of the tibia, navicular, cuboid and calcaneum were prepared for fusion.

The frozen femoral head allograft (Figure 2b) is warmed in saline and decorticated using Rongeur. The femoral head was shaped to match the recipient site and secured with multiple 1.8mm K-wires (Figure 2c). The hindfoot arthrodesis nail (HAN, Synthes, West Chester, PA, USA) was then inserted under image intensifier guidance. Screws were used to increase the stability of fixation between the tibia and the graft. The ankle was then dressed in Jones bandages and supported with a back slab.

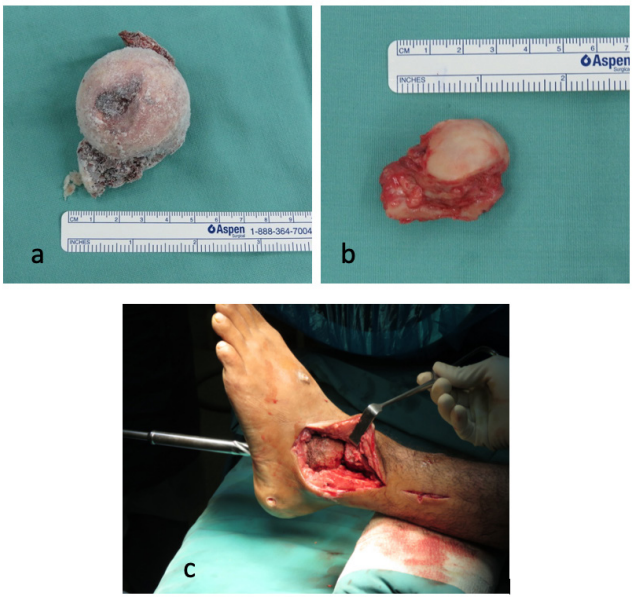

Figure 2(a) : Bulk femoral bone allograft. **(b)** Remnant of the talus with bone loss of talus body. **(c)** A bulk femoral bone graft was inserted to fill in the void between the tibia and hindfoot.

Figure 3 : Anterior-posterior and lateral view radiograph after fixation using bulk femoral head allograph.

The postoperative radiograph showed good fixation of talus to calcaneum and tibia (Figure 3). A below-knee back slab was applied to further

provide support to the ankle. Partial weight-bearing was allowed during the 3rd-month follow-up when radiographic healing was evident. On the 6th month follow up, the patient can ambulate without aid for 10 meters with minimal ankle pain not requiring analgesics. During the last follow up a year later, the patient scored a total of 82 points out of 100 on The American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot scale.

DISCUSSION

Large bone defects of the talus could be caused by trauma, failed total ankle replacement, talus osteomyelitis, talar body tumour, neuropathic arthropathy or avascular necrosis of the talus (2). The advantages of tibiotalocalcaneal fusion include restoration of limb length and better soft tissue balance resulting in better muscular and ligamentous function. However, using structural autograft, allograft or bulk femoral bone graft increases the total bony surface for fusion and risk of late collapse of the structural graft (2).

Fusion of tibiotalocalcaneal arthrodesis using a femoral head allograft to fill the void of a talar bone defect poses a greater challenge. During the commencement of the surgery, our team had taken a significant amount of time in preparation of good fusion surfaces around the bone defect, namely the articular surfaces of the tibia plafond, navicular and calcaneum. This step is of utmost importance to ensure good fusion. The shaping of the femoral head allograft to the size of the defect also posed a challenge. Sharp and prominent edges have to be filed and shaped accordingly to the respective surfaces to ensure a larger area of contact. Constant axial forces have to be applied during drilling and insertion of the HAN nail to ensure good contact of the fusion surfaces and to prevent splinting effect.

The fusion rate of tibiotalocalcaneal fusion using a femoral head allograft has not been studied widely. Jeng et al in 2013 reported a 50% fusion rate from a cohort of 32 patients. They also reported a functional limb salvage of 71% by considering patients who developed stable pseudoarthrosis during follow up (2). Den et al had reported in their study that 4 out of 5 patients who underwent tibiotalocalcaneal fusion using a frozen femoral head allograft showed signs of radiographic fusion during 3rd month follow up after the operation (3). The use of other forms of autograft or allograft in filling the talar defect has yielded a similar good fusion rate.

Other complications had been reported such as nonunion, infections, chronic regional pain syndrome, neuropraxia of the posterior tibial nerve, vascular insufficiency, allograft fracture, prominent implant causing the heel pain, stress fracture and amputatio. However, the patient in this case successfully achieved union during the 6th month follow up without any complications likely due to the care is taken during the surgery to ensure good fusion surfaced, delayed full weight bearing to allow healing and coupled with a relatively healthy patient without any comorbidities.

Jeng et al reported 9 nonunions out of a cohort of 32 patients who underwent a tibiotalocalcaneal fusion with bulk femoral allograft despite utilizing electrical and biological stimulation in most of their patient cohort. Interestingly, they found diabetes mellitus as the single noteworthy factor in the risk of nonunion (2). They had not found any difference between the fusion and nonunion groups with regards to the type of fixation (intramedullary rod or locking plate).

Infection had been reported to be the most frequent factor resulting in amputation. Jeng et al reported 5 cases of infection that resulted in below-knee amputations. The risk for below-knee amputation in their series is as high as 19% (2). Den et al also reported uncontrollable infection in 1 out of their 5 cases and below-knee amputation was done (3).

CONCLUSION

Tibiotalocalcaneal fusions should only be performed and considered as salvage procedures and used to avoid amputation. The goal of such surgeries is to achieve a painless, stable and plantigrade foot that allow ambulation. However, this procedure is not without its possible complications such as nonunion, skin breakdown and infection. Our patient has shown positive results after 4 years of follow up. Tibiotalocalcaneal arthrodesis using bulk femoral bone graft and hindfoot arthrodesis nail is a viable option in the management of large talar defects of the ankle.

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REFERENCES

1. Kolker D, Wilson MG. Tibiocalcaneal arthrodesis after total talectomy for treatment of osteomyelits of the talus. Foot Ankle Int. 2004;25(12):861–5.
2. Jeng CL, Campbell JT, Tang EY, Cerrato RA, Myerson MS. Tibiotalocalcaneal arthrodesis with bulk femoral head allograft for salvage of large defects in the ankle. Foot Ankle Int. 2013 Sep;34(9):1256–66.
3. Den Hartog BD. Femoral head allograft for large talar defects. Oper Tech Foot Ankle Surg. 2012;723–7.
4. Tenenbaum S, Stockton KG, Bariteau JT, Brodsky JW. Salvage of avascular necrosis of the talus by combined ankle and hindfoot arthrodesis without structural bone graft. Foot Ankle Int. 2015 Mar;36(3):282–7.
5. Bishop AT, Wood MB, Sheetz KK. Arthrodesis of the ankle with a free vascularized autogenous bone graft: Reconstruction of segmental loss of bone secondary to osteomyelitis, tumor, or trauma. J Bone Jt Surg - Ser A. 1995;77(12):1867–75.