 CASE REPORT

Femoro-tibial turn-up-plasty (fixator assisted) for infected nonunion of the distal femur

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Case report

A 26-year-old male was involved in a road traffic accident sustaining a left transtibial amputation and an ipsilateral open distal degloving femoral fracture (3B) (Fig. 1). This was treated with an external fixator, split skin graft and an AO intramedullary locked nail. This initial treatment was complicated by infection which resulted in loosening of the nail, confirmed by X-rays and bone scan. Bone scan revealed increased uptake in the cold segment in both the periosteum and the surrounding tissue, with some evidence of revascularisation (Fig. 2).

One year later the patient continued to harbour an active infection at the site both clinically and radiologically. We were reluctant to opt for a high transfemoral amputation, as there may not have been enough stump remaining for an above-knee prosthesis. The aim was to eliminate the infection, restore limb function, and to shorten time to functional recovery.

We performed a tibio-femoral turn-up-plasty to replace the distal femur with the tibia. This allowed preservation of the leg to construct a long stump.

Operative technique

For infection control, Lautenbach1,2 procedure was adopted. This was performed with the application of a bridging limb reconstruction system (LRS) between the proximal femur and tibial stump after removal of the intramedullary nail. Devascularised bone measuring 16 cm was resected from the distal femur and antibiotic cement and Lautenbach tubes were inserted. Irrigation was commenced and continued for 3 weeks.

The second stage of the procedure was the turn-up-plasty with a vascularised tibial graft, assisted by the LRS fixator. A plastic surgeon was also included in the surgical team to carry out the procedure.

An incision was made starting from the medial aspect of the distal stump, extending proximally to the groin, to excise the large scar tissue on the anterior aspect of the thigh. The proximal aspect of the tibial bone was filleted out leaving the posterior muscle attachment and gastrocnemius intact.

The proximal aspect of the tibia was sawn off to obtain a semi-tubular shape. The patella tendon was excised. The fibula was located through the same approach once the anterior aspect of the tibia was exposed and excised. The common peroneal nerve was cut flush and allowed to retract. Following this the distal femoral stump was exposed.
No sign of infection was seen and the wound bed was curetted out and washed with saline. The peroneus was excised from the posterior bed of the anterior compartment and the inter-muscular septum was incised and divided.

In order to obtain skin cover once the fold-over procedure had been completed, the posterior aspect of the calf skin was dissected as a fasciocutaneous flap from the gastrocnemius muscle.

The tibia was turned over 180° and the distal end was attached to the distal end of the femoral stump. An LRS rail was applied using 180/50 mm screws (Fig. 3).

The fracture was compressed and its position checked under the image intensifier. Muscle cover was obtained by suturing the gastrocnemius to remnants of the quadriceps. A dressing was applied in the usual manner. The fixator was removed 4.5 months later, after achieving clinical and radiological union. Post operatively the patient had some soft tissue swelling around the stump which resolved spontaneously.

The patient had a prosthesis fitted and, on 2-year follow up, has good function in his leg with no sign of infection (Fig. 4).

Discussion

The turn-up-plasty procedure, although rarely performed, provides an opportunity to preserve the patient’s own bone and to achieve good function of the leg.

The original procedure was first described by Sauerbruch in 1922. Since that time, most of the literature regarding turn-up-plasty describes variations on the original procedure. Thompson (1956) discussed fitting the tibia and/or the fibula into the acetabulum. Wieder and Nicholson (1956) described fitting an endoprosthesis into the distal tibia prior to the turn-up and fitting the prosthesis into the acetabulum. Bohne (1987) and Williamson (1992) describe preservation of part of the femur with reconstruction of the fibula, so that it can be inserted into the tibia and then into the femur.

Tronzo and Janek described a turn-up-plasty to treat an infected femoral prosthesis in which the infection involved the whole length of the femur. After performing a foot amputation and preparing a skin flap, the distal tibia was used to insert a bipolar femoral prosthesis, and that was turned-up to the acetabulum with skin flap cover. The infection persisted for another year, and a disarticulation was performed.

Song et al. described a conceptually similar procedure where the distal part of the tibia was turned up to make a longer below knee amputation stump.

Peterson et al. described a musculo-cutaneous rotation of the tibia and hind foot to restore amputation length after extensive proximal femoral bone loss. Harvesting the calcaneus and talus along with the tibia allowed them to fuse only the calcaneum to the pelvis, thereby creating a new hip with the tibiotalus articulation.

McDonald et al. reported seven cases of turn-up-plasty to treat distal femoral deficiency after tumour resection. In their series, there was one infected allograft and one case of chronic osteomyelitis secondary to reconstructive surgery, post tumour resection. They used an internal fixation device to connect the femur to the tibia in their series.

Van Nesc in 1948 performed two types of turn-up-plasty to treat femoral deficiency post tumour resection—complete and partial. After 22 years follow up, and after treating more patients with the same technique, Van Nesc stated that partial turn-up-plasty was an excellent operation, giving
functional results that are far superior to high amputation of the thigh and disarticulation of the hip. Furthermore, he added total turn-up-plasty, especially after tumour resection, is very disappointing.

The cornerstone of any treatment of chronic osteomyelitis must continue to be the radical debridement of all involved necrotic, infected soft tissue and bone. Any microvascular free tissue transfer over infected tissue is doomed to failure but a free tissue transfer that is used judiciously after the eradication of all infected bone and soft tissue appears to be a useful technique for controlling osteomyelitis.

It is sometimes obvious that immediate amputation is the correct management in cases of severe trauma to a limb but on other occasions the decision of amputation and attempts at salvage can be difficult.5

In this case, in order to treat the infected non-union, the choice was either high amputation of the thigh (or possible disarticulation of the hip) or reconstruction. After a high thigh amputation, the patient is left with a short stump, which is difficult to dress, and even when equipped with a modern prosthesis, permits only an imperfect, awkward and staggering gait. The gait is in stark contrast with that of the patient whose amputation is performed below, or at the level of the knee. Because of this difference of gait, and to avoid long reconstructive procedures, we wished to provide a long stump, descending to the level of knee. In this way, we could facilitate our patient’s physical and psychological well-being: physical, by giving him the chance to walk without difficulty and by reducing his incapacity and psychological by minimizing the amputation and restoring his leg’s ability to function. These factors are of great importance.
In all the above reported cases, the authors performed an internal fixation to fix the tibia to the femur. In our case we were faced with the challenge of chronic infection; therefore, fixation was performed with the assistance of LRS, to minimize the risk of infection, and also to maintain the anatomical axis of the new stump.

**Conclusion**

The tibial turn-up-plasty is an effective procedure that results in a long functional amputation stump despite a very high above knee resection. Like other authors, we recommend that the technique of turn-up-plasty should be reserved for patients who have
had multiple previous surgical failures and in those with deep seated infection.

To our knowledge this method of turn-up-plasty to treat bone loss after infected nonunion in the distal femur and traumatic transtibial amputation, benefiting from the assistance of external fixator, has not been previously reported.

References