New technique for below ankle amputation:  
“The hero-heel” technique

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ABSTRACT

Objective: A new below-ankle amputation technique is described. The technique is called the “hero-heel” technique in reference to the patient for whom the technique is suitable. He is usually a soldier who suffered a traumatic foot amputation as a victim to a personnel mine. The technique overcomes the known shortcomings of established procedures, namely backward migration of the heel pad, shortening of the affected limb, and difficulty of prosthesis fitting.

Methods: The “hero-heel” procedure is carried out by creating a wedge between the talus and the calcaneus after excising the head and neck of the talus and rotating the calcaneus anteriorly by 90 degrees to fuse it with the talus, sparing the ankle joint in the process.

Results: The procedure was performed on 50 patients during the period from July 1986 to January 1989 in Mosul Military Hospital. These patients were followed up to 1998 to monitor their physical and social rehabilitation.

Excellent end-bearing stump with no shortening of the limb and no equinus deformity was the result in all patients. The problem of posterior migration of the heel-pad was eliminated. Most patients did not need to fit sophisticated prosthesis. Shoe fitting was enough. Six months after the operation, all patients got complete fusion of talus and calcaneum that could move as a single bone at the ankle joint.

Conclusion: The “hero-heel” technique solved the chronic problems associated with other known, below ankle amputation techniques. The new technique is easy to perform and avoids the removal of bones as in other established procedures. After 10 years of follow-up, all 50 patients were economically active and perform their daily activities without the use of crutches or other aids.

Keywords: New technique, below ankle amputation, hero heel technique.


In the normal standing position, half of the weight of the body is supported by each talus. The talus transmits half of this weight backwards through the calcaneum to the heel (H), while the other half is transmitted from the talus forward to be distributed equally to the 6 bearing points in the foot, namely the heads of the lateral, 4 metatarsal bones and the 2 sesamoid bones at the head of the first metatarsal bone (HM).

During walking, one of the 2 points, (H) or (HM), touches the ground. In the erect position, the line of gravity falls in front of the ankle joint. There is a continuous tendency for the tibia to slide forwards over the talus. This tendency is efficiently resisted by the strong talo-fibular and caleno-fibular ligaments.

Traumatic amputation of foot. Most of the traumatic amputation of the foot results from mine explosion when one of the 2 points (H) or (HM) steps onto the mine forcibly causing the explosion.

If the explosion takes place under the heel (H), it is usually followed by a severe compound comminuted

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fracture at the calcaneum, talus, lower end of tibia and fibula. This type of injury leads to disturbance of normal anatomical and physical properties of both standing and walking. Above ankle amputation is then required in such instances. If the explosion happens under the fore foot at the head of metatarsal bones (HM), the result is usually a severe compound comminuted fractures of the fore foot bones ranging from traumatic amputation of the fore foot in addition to soft tissue loss to compound fracture and skin loss.

Amputation through the metatarsals is disabling and is related to the level of the amputation. The more proximal the level, the greater the disability. The loss of the push-off mechanism in the absence of a positive fulcrum in the ball of the foot is chiefly responsible for impairment of the gait. Amputation more proximal than the transmetatarsal level results in a considerable awkwardness in walking caused by lack of support and the inability to push-off.

Methods. There are, mainly, 6 different amputation techniques that deals with amputation of the foot: Lisfranc’s: which is at the tarso-metatarsal joints; Chopart’s: which is at mid tarsal joint; Pirogoff’s: arthrodesis between the tibia and parts of the calcaneus after removal of talus and rotate calcaneus 90 degree anteriorly; Syme’s: sub perosteal resection of calcaneus leaving the heel flap, to be fixed by Kirschner wire to the transected articular surface of the lower tibia and fibula about 0.6 cm parallel to the ground; Wagner’s modification: (Two-stages Syme’s amputation; Patients with gross infection of forefoot and in diabetics; Boyd’s: (Talectomy, forward shift of calcaneus and calcaneo-tibial orthodrosis.

All these techniques suffer from the following disadvantages: 1. Limping due to an obvious shortening and equinus or equino-valgus deformity. 2. Posterior migration of heel pad due to muscular imbalance acting at the stumps and 3. Technical difficulty in fashioning and fitting prosthesis to patients who are usually active young males.

The “hero heel” technique. The new technique, which is advocated here, is called “hero-heel” in reference to the patient to whom the procedure is performed. The procedure normally refers to a young man in the military services who falls victim to a personnel mine. The procedure was performed on a patient who had sustained a trauma for less than 3 months. An incision is made, starting 1/2 cm anterior to the distal end of the lateral malleolus and passes 5 cm across the anterior aspect of ankle joint above head of talus, to a point 1/2 cm anterior to the tip of medial malleolus. It is extended directly plantar wart and across the sole of the foot 2 cm above the heel pad to end it in the starting point. A leaf-shape skin flap is created and dissection of the flap and deep tissue is carried out, until the bone is reached taking special care not to open the capsule of ankle joint. (Figure 1, stage 1). The head of talus is exposed and excised obliquely. The head, neck part of body are excised in a direction parallel to the ground in erect position. (Stage 2). A wedge resection is carried out between talus and calcaneum directed posteriorly until the tendo-achilles is reached. Dissection of the soft tissue is performed from the lateral and medial surfaces of the superior part of the calcaneus and the heel is pulled into even more equinus position till it freely rotates. A raw surface in calcaneum is prepared to fit the excised talus after rotating the calcaneum 90 degrees posteriorly. (Stage 3). These bones were fixed by k-wires pined from the dome of the heel pad passing through ankle joint to the tibia. (Stage 4). Then the wound is closed in 2 layers with suction drainage. If the tendon of tibialis anterior or any extensor is not cut at a previous operation, these are sutured to the planter fascia in front of calcaneum. Tendon of tibialis posterior, flexor hallucis, flexor digitorum, should be transferred and sutured to extensor tendon if possible. Soft dressing is applied and removal of the stitches is carried out 14 days, postoperatively. After 2 months the pin is removed. Patients are encouraged to be weight bearing after 3 months. Patients who had sustained a trauma for more than 3 months, lengthening of tendo-achillies is performed before the above procedure.

Patients and settings. A total number of (2,331) patients had an orthopedic operation performed on them during the period of 30 months from July 1986 to January 1989 in Mosul Military Hospital. Out of those, 456 (19.5%) patients had an amputation operation.

The hero-heel operation was carried out on 50 patients and these were followed up to 1998 to monitor their physical and social rehabilitation. The age range from the 50 patients was 20-29 years. As 40 patients (80%) exhibited that age range, only 2 (4%) were below 20 years and the remaining 8 patients (16%) were above 30 years. The median period of time from the onset of injury to the last operative procedure was 86 days. The median number of hospitalization days was 22, all of them are military personnel.

Results. There was excellent end bearing stump. It was the most satisfactory functional stump that the patients could withstand. The problem of posterior migration of heel pad was eliminated. These show no shortening of limbs or equinus or equino-valgus deformity due mainly to the sparing of the function of the ankle joint. There was only mild wasting of calf muscles in 45 patients (90%). Most patients did not need to fit a sophisticated prosthesis. Shoe filling was enough. No complaints of phantom limb was recorded. Only in 5 patients did suture line problems develop, ranging from stitch abscess to gangrene and slough.

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Figure 1 - All stages in performing "hero-heel" technique.
of skin of both edges. These were managed by opening the stitches and debridement of skin with resuturing or skin grafting. After 6 months follow up, all patients had complete function of talus and calcaneum and could move as a single bone at ankle joint. (Figure 3). After 10 years, the 50 patients in mid 1998 became economically active and returned to life practice as usual without the use of crutches or human help. Some of them were employed in heavy work such as petrol-station attendants, truck drivers, farmers, lawyers, engineers and teachers.

One patient was reported that he was dancing a folklor dance using his limb more than 3 hours at one go. Another was playing football without being signaled out as a foot amputee.

Discussion. After 10 years, the close follow up of patients with hero-heal technique showed that there was an excellent end bearing stump. Most patients (96%) did not need physical or psychological rehabilitation and returned to their previous work or profession. Two patients out of the 50 were referred to physical rehabilitation. Both patients suffered from partial ankle stiffness. In comparing this new technique with the ordinary procedures of amputation, one finds that the hero-heal solved the chronic problems of foot amputations. The technique is easy and did not necessitate the removal of parts of bones as in Boyd’s, Pirogoff’s, Syme’s and Wagner’s. The ankle joint was not opened. An excessory length was gained and the foot could move
freely at the stump and severe wasting of calf muscles is spared.

References

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