

Case Report

Correction of neglected post-burn severe calcaneo-valgus deformity of foot with Joshi's external stabilization system: a one stage surgical procedure

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ABSTRACT

Post burn calcaneovalgus is a complex foot deformity and management becomes increasingly difficult especially if deformity is neglected in growing young child resulting in secondary bony deformity. A simple technique of single stage surgical correction with Joshi's external stabilization system (JESS) is described using principle of distraction osteogenesis or histogenesis without need of extensive plastic surgical procedure. A functional plantigrade foot is achieved after completion of the procedure without need of any bony procedure and least chances of any neurovascular compromise. JESS is a versatile external fixation device for correction of neglected postburn complex calcaneovalgus deformity.

Keywords: Postburn, Calcaneovalgus deformity, JESS

INTRODUCTION

Burns are a cause of significant morbidity and mortality and constitute the second most common cause of trauma related deaths after vehicular accidents.¹ Post-burn scars are an inevitable consequence of deep burns even with the best of treatment and such scars around the joints may be complicated by debilitating contractures severely compromising the extremity function, thus resulting in serious disability.^{2,3}

Among all the post burn deformities, foot contractures constitute 5-7% of deformity in adults and 10% in children.^{4,5} Conventional methods of correction through extensive soft tissue releases, scar resection, grafts and flaps, osteotomies and arthrodesis have many disadvantages including neurovascular injuries, limited

soft tissue coverage, donor site morbidity and shortening of foot.

This case is presented for its complexity, rigidity and safe simple technique of its correction with distraction histogenesis using Joshi's external stabilization system (JESS).

CASE REPORT

JESS was chosen in a boy of 12 years who had sustained thermal injury (wet burn) to his right foot at the age of 6 years and had progressed to severe calcaneo-valgus deformity (Figure 1). The deformity was corrected through distraction histogenesis with JESS and foot was made plantigrade in single stage without going through extensive soft tissue or bony procedures.

Surgical technique

The procedure was carried under general anaesthesia. Two parallel K-wires, 3 to 4 cm apart were passed in proximal tibia from lateral to medial side, one finger breadth below tibial tuberosity. Two parallel K-wires were passed through tuber calcaneum from medial to lateral side with one additional half pin from posterior aspect of calcaneum along its long axis starting just below insertion of tendoachilles. One transfixing K-wire was passed through necks of first and fifth metatarsal from lateral to medial side with two additional parallel K-wires from either side engaging three metatarsals each. Two 'Z' rods were attached to tibial pins, one on either side, stabilising them with two transverse connecting rods one anteriorly and one posteriorly. Additional 'L' rods were attached to calcaneal and metatarsal K-wires, one on either side with arms of the 'L' facing posteriorly and inferiorly. One posterior transverse rod was attached to posterior calcaneal half pin and posterior arms of calcaneal 'L' rods. Two additional transverse rods were attached to inferior arms of calcaneal and metatarsal 'L' rods. Calcaneometatarsal and tibiocalcaneal distractors were then applied on either side. Multiple horizontal stab incisions were given in the contracted scar tissue (Figure 2).



Figure 1: Post burn calcaneovalgus deformity right foot in 12-year-old boy.



Figure 2: Post application of JESS.

Differential distraction was carried out on calcaneometatarsal and tibiocalcaneal rods with regular assessment of correction and readjustment of foot in corrected position in the frame until desirable correction was achieved (Figure 3). The frame was continued in a static position for double the time needed for correction following which a below knee walking cast was applied in maximum correction for 3 weeks.



Figure 3: Post JESS correction.



Figure 4: After correction and removal of JESS.



Figure 5: Radiograph of foot AP and lateral view.

Correction was achieved within 6 weeks following distraction. JESS was continued for six more weeks to allow for soft tissue maturation. Stable plantigrade foot was achieved at the completion of treatment with AOFAS score of 79 compared to pre-operative score of 32. All the soft tissues around the ankle were safely preserved. Medial arch was however not restored and the foot was shortened compared to the normal foot by about 1 cm (Figures 4 and 5).

DISCUSSION

Post burn contractures of the feet are mostly complex deformities and become increasingly difficult to correct if neglected for a long time. The secondary bony deformity and nonpliable scar tissue makes any surgical procedure more difficult. Extensive plastic surgical procedure including flaps are increasingly needed. Many cases need bony procedure before any plastic surgical procedure is done.

Calhoun et al 1992, in a review has found that corrections of chronic post burn deformities of foot and ankle are relatively easy to correct with Ilizarov fixator if in a single plane like equinus, cavus, rockerbottom, and toe dislocations while as complex deformities with varus, valgus components, bone abnormality, or muscle loss are more difficult to correct.⁶

Erdoğan et al 1996, reported a case series of 7 cases including two cases of post traumatic and congenital dorsiflexion.⁷

Contractures existing for a long period of time cannot be brought into anatomic position easily because of shortened tendons, nerves, and vessels or ankylosed joints. Although tendons can be lengthened in one operation, this is not the case for neural and vascular structures. The dorsiflexion post burn deformity was corrected partially with soft tissue procedure like incision or Z-plasty or osteotomy followed by further gradual correction by distraction with the use of external fixator till full correction was achieved and finally by split thickness skin grafting. All the cases were able to walk normally.

Thomson et al described that complex deformities of the foot and ankle remain a difficult problem for even the most experienced surgeon.⁸ Each deformity is unique and the surgeon should be capable of using multiple techniques to provide the most appropriate treatment for the patient and the deformity. It is usually possible to provide a functional outcome but never possible to provide a complete normal foot or ankle. If appropriate goals are set, correction of these challenging deformities can be satisfying to surgeon and patient.

Shakirov evaluated different surgical techniques for correction of post burn contracture of foot and ankle of different degrees.⁹ The choice of operation was made on the basis of severity and localization of deformity. He used

local uninjured tissue and soft scars to make trapezoid, Z-plasty or other shaped flaps and also free grafts placed on the area of the excised scars. He observed the follow-up during a period of one to eight years in 57 patients with burn deformities of the ankle. In 41 cases (71.9%) the deformities were completely eliminated and in 13 cases (22.8%) the results were satisfactory; three patients (5.3%) had poor results. In the follow-up the scars became thinner, softer, and more elastic due to the elimination of tightening. In most of the cases the deformities were not severe. Early surgery was recommended depending on severity of the contracture.

Youbai et al reported use of gradual distraction with external fixator for severe post burn ankle contracture.¹⁰ This study included 5 cases of dorsiflexion contractures and single case of dorsiflexion with varus ankle deformity. After excision of scars, conservative correction of the articular position was done, avoiding exposure or overstretch of the tendons, ligaments, and neurovascular bundle. The subsequent defect caused by scar resection was then covered by skin grafting. The preconstructed external fixator was applied and K-wires were inserted as preoperatively planned. The distraction was started after 10 days allowing skin graft to heal. Normal plantigrade foot with normal gait was achieved in all cases. Surgical planning using patient-specific three-dimension-printed models significantly reduced operation duration and increased patient satisfaction, while providing similar improvements in ankle movement and function compared to traditional 2-dimensional surgical planning for the correction of severe postburn ankle contracture with external fixators.

A case of correction of combined burn contracture deformity of foot has been described by Bari et al 2022, using Ilizarov frame and plastic surgical procedures.¹¹ The case was a 9-year-old child who had sustained boiling water burns a year before admission. The patient had developed a severe burn scar deformity of the feet and disturbed gait. Excision of scar tissue on dorsal aspect of foot and lateral surface of tibia and full thickness skin grafting of cutaneous defects was done. Subluxed metatarso-phalangeal joints were corrected with Ilizarov external fixation. Although plantigrade foot was achieved, they recommend further improvement in technique depending on the individual characterization of anatomical and functional impairment of the foot.

The case under study had neglected the deformity for almost six years resulting in secondary bony changes making correction increasingly difficult. The scar tissue being difficult to stretch, multiple horizontal stab incisions were made on scar tissue and overlying skin. This allowed JESS fixator to work simultaneously by differential distraction and correct both dorsiflexion deformity of ankle, valgus of heel as well as residual forefoot valgus deformity. The simultaneous correction of all deformities and plantigrade foot was achieved without need of any extensive bony or plastic surgical procedures.

In a neglected deformity although a good functional plantigrade foot is achieved but it is very difficult to get a normal radiographic bony alignment and long-term complications of secondary osteoarthritis cannot be ruled out.

CONCLUSION

Applying the principle of distraction histogenesis is an effective method in treating severe burn contractures in the ankle joint obviating the need for extensive soft tissue release and its complications. The use of JESS for the same has encouraging results and is thus recommended.

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