

Management of Severe Postburn Contracture Deformity of Both Knee and Ankle Joint by Gradual Skin or Skeletal Traction with STSG to Resurface the Defect

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Abstract: Severe postburn contracture deformity of both knee and ankle joint causes severe functional limitations. The mainstay of treatment is early surgical excision of contracture tissue and resurfacing with STSG, local flaps and free flaps. All patients admitted with severe postburn contracture of knee and ankle joint between January 2016 to April 2018. All underwent staged management with excision of contracture tissue followed by continuous skin or skeletal traction. And after correction of residual joint contracture the defect is resurfaced with STSG. In all patient's correction of flexion deformity was achieved. Graft failure was present in 5 patients, in which 2 required re-grafting. Staged treatment with excision followed by continuous traction and then resurfacing with STSG. Customized post-operative splintage results in full correction with adequate coverage of knee and ankle joint contracture.

Keywords: Burn, Contracture, Knee, Ankle, Traction.

INTRODUCTION

Burn injury continues to be a major epidemiologic problem around the globe. Nearly 1/4th of all burn injuries occur in children under the age of 16, of whom the majority are under the age of five [1].

Burn trauma is one of the most common causes of trauma-related deaths, both in developing as well as in the developed world.

An extensive burn is the most devastating injury a person can sustain and yet hope to survive. A healed burn patient may be left with scars and contractures of varying degrees with diminished functional and aesthetic components [2]. Their actual incidence is not known. However, it is inversely proportional to the standards of initial treatment with patients receiving best of care having minimum number and severity of these problems

Postburn knee flexion contractures cause functional limitations of all lower extremity, not allowing the patient to walk normally, creating serious cosmetic and functional defects, and, therefore, requiring surgical intervention.

Knee postburn scar flexion contractures, making up 22% of large joint contractures [1], and along with ankle contracture, they affect the leg motion, impair the lower extremity function, present cosmetic defects, and therefore requires early surgical treatment. The contracted scars undergo (during joint extension) severe tension, tearing, and often are converted to pathologic scars- rough, thick, solid, prone to keloid growth and ulceration. Review of literature shows that there is less research on knee and ankle scar flexion

contractures, than on the large joints of upper extremities, when it comes to surgical treatment. There is no existing anatomical classification of flexion contractures that could serve as a guide, for reconstructive technique choice, which presents a clinical challenge [3]. Many surgical techniques have been described; however, an ideal method is yet to be found. The most common treatment methods are based on the incisional contracture release and skin grafting or on the local triangular flap techniques [4]. Rarely, regional pedicled or free flaps and Ilizarov fixator are used. The anatomical and functional peculiarities of the ankle joint, which is characterized by its complex structure and the absence of protective adipose and muscular tissue, may lead to severe contractures after deep Functional disturbances of the ankle joint may severely affect posture and gait, and can even lead to distortion of the pelvis, curvature of the spine, and other paid to rehabilitation surgery of post-burn deformities of the knee and ankle joint. Serious deformities of the knee and ankle joint may burn are characterized by such severe deep injuries because of a close contact of the body with live coals or wood and include not only skin injuries of various depths but also injuries to underlying tissues: subcutaneous fat, fasciae, muscles, and even bones. Most surgeons assess scar-related joint

contracture Ankle joint contractures are classified into four different degrees in reference to the neutral position of the foot. The amplitude of ankle joint movements is taken into consideration as a basis, normally equal to 65-80°, i.e. 40-50° of plantarflexion and 20-30° of dorsiflexion. The extent of the contracture is determined in relation to the limitation of movement expressed in degrees.

The creation of a rehabilitation system for patients with post-burn extremity deformities, for out-patient follow-up treatment, and for home therapy is thus a problem of particular significance. Although the literature has much to say on the various issues of rehabilitation and reconstructive surgery in the although surgical techniques are widely described in the literature, different opinions exist with regard to the choice of methods, depending on the localization of the defect, its severity, and the patient's age.

In the light of these considerations, it is clear that the development of a rehabilitation system for such patients is of critical importance

MATERIALS & METHODS

All patients admitted in plastic surgery ward of NRS medical college and hospital with severe postburn contracture of knee and ankle joint between January

2015 to November 2017. All patients underwent staged treatment for correction of deformity of knee and ankle joint.

In first stage – excision of the scar tissue over the popliteal and dorsiflexed contracture over the ankle region was done followed by application of skin surface (spat) traction or skeletal traction for the residual contracture

- Traction was applied for 4 weeks and alternate day moist dressing was done.
- In second stage – defect over the popliteal and ankle region was resurfaced with STSG.
- Graft fixation was done with the skin staplers and fibrin tissue glue (Tisseel).
- First dressing done on postop day 5 followed by alternate day dressing till graft is settled
- Customized thermoplastic splint was applied for 4 weeks day and night followed by night splinting for 6 weeks.
- Post-surgical analysis was done by analyzing the number of cases having graft failures & number of patients requiring re-grafting.

RESULTS

14 males and 6 females were assessed and type of burn injury causing contracture was recorded

Table-1: Age distribution

Age group (years)	
<10	2
11-20	8
21-30	5
31-40	3
41-50	2

Table-2: Mode of Injury

Flame burn	Contact burn
15	5

On analysis maximum patients were found to be in second decade of life. Flame burn is more commonest mode of injury

Time of presentation post burn – minimum was 2 years and maximum was 8 years

Table-3: Site of contracture

Popliteal region	11
Ankle region	5
Both sites	4

Table-4: Traction applied

Surface (Spat) traction	Skeletal traction
8	12



Fig-1: Severe post burn contracture of knee and ankle joint



Fig-2: Defect of popliteal region and ankle region after continuous traction and resurfaced with STSG



Fig-3: Defect of ankle region resurfaced with STSG after continuous traction

There were 11 patients out of 20 having popliteal contracture, 5 patients with ankle contracture and 4 patients are having contracture at both sites

On analysis all the cases with ankle contracture skeletal traction was used, whereas in 5 patients with

popliteal contracture skeletal traction was used. In 5 patients there was graft failure, out of which 3 patients require re-grafting while 2 are healed by secondary intention.



Fig-4: One month follow up with child standing

DISCUSSION

The presence of burn contractures is inversely proportional to the standards of initial treatment, with patients receiving best of care having minimum number and severity of these problems. But sometimes it is also negligence of these injuries in the face of the much bigger problems that these patients face such as an accompanying large burn area elsewhere on the body or the presence of inhalational injuries which leave the patient immobilized for long periods of time

An understanding of the burn wound healing is fundamental not only to the management of the acute burn wound, but also for the prevention, minimization and treatment of post-burn scars and scar contractures [5, 6]. The healing of a burn wound is accomplished either by *restitution* (complete regeneration) or *substitution*. Restitution is possible in superficial burns where the stratum papillare and all the specialized cells of the organ are preserved. The epithelial cells are derived from the epithelial appendages such as sweat glands in the central portion and wound edges at the periphery. The sequence of cellular events that comprise epithelialization include cellular detachment, migration, proliferation and differentiation.

As in the cases of second degree burns, skin is affected deeper in the zone of stratum reticulare, then the defect is covered by substitutive unspecialized connective tissue. The final result is demonstrated by a lesser or more extensive formation of the cicatrix. With full thickness loss of skin, wound contraction and epithelialization from the margins occurs leading to contractures.

Contraction is an active biological process by which an area of skin loss in an open wound is decreased due to concentric reduction in the size of the wound. Wound contraction involves an interaction of fibroblasts, myofibroblasts and collagen deposition and is a satisfactory mechanism when the tissue loss is

small, in a non-critical area and surrounded by loose skin.

Scar contracture, on the other hand, is the end result of the process of contraction where because of a large tissue defect a larger quantity of collagen deposition occurs. When this process occurs across the joint lines it will lead to joint contractures

Planning release of joint contractures involves assessment of scar maturity. Mature scars are soft supple and avascular and their release is much easier and chances of graft survival better

On excision of scar tissue from joint area deep till the fascia will release the contracture till some extent but the residual contracture can be only corrected by continuous traction.

In our study, most patients were relatively young. The socio-economic implications of such disabling conditions are even more devastating given the economically productive age of the victims. Several published studies have described a similar frequent involvement of younger individuals [7].

Male are commonly affected due to their increased outdoor activities and workplaces. Flame burn is the predominant cause of burn in our study than contact burn. Flame burns most commonly resulted from accidents due to leakage of natural gas used as domestic fuel for cooking purposes, to clothing catching fire in the kitchen, to accidents with LPG gas cylinders, and to exploding CNG cylinders in vehicles

There were 11 patients out of 20 having severe popliteal contracture, 5 patients with severe ankle contracture and 4 patients are having contracture at both sites.

On analysis all the cases with ankle contracture skeletal traction was used, whereas in 5 patients with popliteal contracture skeletal traction was used.

All the defects were resurfaced by STSG, in which 5 patients had graft failure. Out of 5 patients, 3 required re-grafting and remaining 2 healed by secondary intention on regular dressing.

CONCLUSIONS

It is now well established that a burn victim who receives the best initial treatment can expect to heal without any contracture [3, 4].

Intensive exercise programs and rehabilitation should be instituted at the very beginning of burns management. Adequately performed anti-deformity positioning and regular exercise also helps to avert the risk of contracture formation [8-10].

Local flaps produce aesthetically and functionally satisfactory outcomes when used for the reconstruction of burn contracture defects. But the available options for local flaps is very less due to large defects and less healthy tissue. Free perforator flaps are definitely a good option but ultra-sophisticated equipment's and increased technical expertise are prerequisites along with increased operation time and patient morbidity.

Beneficial algorithms have been invented which assist reconstructive surgeons in selecting appropriate reconstructive methods after release of burn scar contractures. These algorithms are an attempt to simplify the approach to burn contracture reconstruction. Advantages and disadvantages of these different modalities should be considered and compared before carrying out the treatment.

However, there are some limitations in using STSG which should be considered. They do not provide the best possible color/texture match, skin elasticity, or ideal cosmesis. There is also a tendency to secondary contractures and late recurrence. Additionally, there is a need for post-operative physiotherapy, splintage, pressure garments, and anti-deformity positioning for several months. When STSGs are employed in combination with dermal substitutes such as Integra and Alloderm, the quality of reconstruction is greatly enhanced, and most of the aforementioned problems are solved. The cost of dermal substitutes is the main barrier to their availability, and hence to their general use.

Surface (spat) and skeletal traction is a good modality of treatment for correcting post burns flexion contracture of the knee and ankle. It can be used as a procedure with local anesthesia and can be applied to all age group. Slow progressive and prolonged stretching helps in full correction without serious complication.

Patients and their parents need good motivation, as prolonged follow up and after care, in the form of pressure garment, splint, scar massage and exercise are necessary. Cotton padding with elastocreep bandage helps in reducing blister formation which is very common with compression stocking. Blister formation is the commonest cause for discontinuation of pressure garment and splint. Serial stretching being another tool in the armamentarium of burns surgeon helps in the simultaneous correction of multiple deformities or in patients with high chance of hypertrophic scarring or when surgical correction is not possible. Early splinting, proper positioning and mobilization helps to prevent development of contracture. Splinting and pressure therapy has to be continued till the scar fully matures, to prevent scar hypertrophy and recurrence of contracture.

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