Clinical Research on Foot and Anke

Shakirov, Clin Res Foot Ankle 2015, 3:1
DOI: 10.4172/2329-910X.1000166

Research Article Open Access

Surgical Treatment of Post Burn Bent Contractures of the Foot in Children

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Received date: Mar 5, 2015; **Accepted date:** May 5, 2015; **Published date:** May 7, 2015

Abstract

The post-burn bent contracture deformity of feet in children represents a challenging and complex specific pathology of the weight bearing motor apparatus. According to the findings of burn department of RSCUMA and Inter-Regional Burn Centre of Samarkand, Uzbekistan burn contractures of the toes are observed in about 72% of patients.

During the period of 1992-2007, 112 patients with post burn bent contractures of toes were treated. The patient's ages, severity of deformity, and treatment method were followed for an average 1-5 years. Deformity was classified from I to IV degree according to the classification given by Parin BV. The choice of surgery was made on the basis of the severity and localization of the injury. The patients were followed-up during a period of one to ten years. 112 of patients were treated with surgical intervention to restore function and reduce deformity. The relative occurrence of the different types of burn contractures of the foot was as follows: mild type-21; moderate type-44; severe type-29; multilated type-18.

In 79.5% of cases, contracture was removed absolutely in 14.3% there was an improvement and only in 6.3% of cases there was no improvement because of the irreversible bone-joint change.

Keywords: Burns; Foot; Bent contractures; Surgical treatment

Introduction

One of the most challenging aspects in patients recovering from burns to the lower extremities is the rehabilitation and restoration of function to the foot [1].

Post-burn bent contractures are a devastating problem for both the patients and treating practitioner. Based on degree of deformity, options have been proposed, etc.

- A post-burn contracture in children is especially difficult to treat as the patient's ages and bone will continue to grow over time. If untreated, deformities may worsen, joints may adapt, etc… The post-burn contracture deformities of feet in children represent the complex specific pathology of weight bearing-motor apparatus developed after severe burn of the feet.
- Protective capacity of footwear and considerable thickness of sole skin ensures that the sole of foot gets injured only when the foot is in direct contact with hot object and fluids. Restate the sentence for clarity and purpose [2].

Special attention should be paid to clinical investigation of the so called "Sandal Burns" which are common in some Central Asian regions, where the people uses an ancient, primitive heating device-Sandal [3-5]. Sandal burn injuries (75-80%) mostly of distal parts of forefoot can be often observed in children under 3 years of age. To treat the contracture of toes, it is important to provide immediate correct treatment to deep burns of sole of feet and the skin covering it.

The main methods of local treatment of severe burns of the sole in addition to other effective methods, included necrotomy, necrectomy and early autodermoplasty [6,7].

The investigation done shows that post-burn contracture of feet toes is more common in children. Most surgeons assess scar-related joint contracture using a scale proposed in 1946 [8] which reflect the severity of joint dysfunction.

Continuous existence of such deformities results not only in disturbances of static, gait but also in various osteoarthritic deformities like a beak, falx, valgus, varus foot. Growth of the foot can also be disturbed. Surgical treatment of post burn bent contractures of the toes is difficult [9,10]. The aim of the present study was to evaluate different surgical treatment of post burn bent contracture of the toes.

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

Patients and Methods

During the period 1992-2007, we treated a total of 112 patients with post burn contractures of toes were treated in burn department of RSCUMA and Inter-Regional Burn Centre of Samarkand, Uzbekistan. The causes of the burns were as follows: 67.1% (n=75) suffered from sandal burns, 14.3% (n=16) from hot ash and asphalt burns, 5.5% (n=6) from flame burns and 16.4% (n=21) contractures had burns caused by other reasons (Table 1).

Kind of burns	№	%
Sandal burns	75	67.88

Ash and asphalt burns	16	14.3
Flame burns	6	5.5
Other burns	15	13.4
Total	112	100%

Table 1: Aetiology of the burn injuries.

The age distributions showed that 25.0% (n=28) contractures were under 3 years old, 30.3% (n=34) contractures were between 3 and 5 years old, 15.2% (n=17) contractures were between 5 and 10 years old and 29.5% (n=33) were more than 10 years old (Table 2).

Deformity was classified from I to IV degree according to the classification given by Parin B.V. Toes joint contractures are classified into four different degrees in reference to the neutral position of the foot. The extent of the contracture is determined in relation to the limitation of movement expressed in degrees.

First and second degree contractures were observed in 36 cases, third degree in 53 cases, and fourth degree in 23 cases.

The relative occurrence of the different types of burn contractures of the foot was as follows: mild type-21; moderate type-44; severe type-29; multilated type-18. 112 patients we operated under general anaesthesia.

The age distributions of the contractures	**№**	**%**
Under 3 years old	28	25
3 and 5 years old	34	30.3
5 and 10 years old	17	15.2
After 10 years old	33	29.5
Total	112	100%

Table 2: Distribution of burn age.

In the absence of bone deformities of the foot (I-II degree), skin graft was performed in 32, 1% (36 cases). Rough, plane and ulcerous scars were incised on the whole expanse. The wound defect having developed in 24-48 hours after release of contracture was covered by splint thickness skin graft 0.4-0.5 mm from the external and internal surfaces of the hip. At the same time, contractures of toes were treated by means of overextension by 30-40° (Table 3).

Deformation type	**Cases number observed**	**Good**		**Improvement**		**Without change**	
		Cases number	**%**	**Cases number**	**%**	**Cases number**	**%**
I-II degrees	36	36	100	-	-	-	-
III-degree	53	42	79.2	10	18.9	1	1.9
IV-degree	23	11	47.8	6	26.1	6	26.1
Total	112	8900%	79.5	16	14.3	7	6.3

Table 3: Results.

In contractures of III-IV degrees (54.5%-61 cases) with dislocated toes, the pathological tissue was cut up to metatarso-phalangeal joint. To fix the toes at the achieved corrected position, a Kirschner wire spoke was inserted through a bone or joint, through the first toe and the rest, depending on the age of child-either spoke or injection needles of middle size specify were used.

In cases of failed fixation by spoke, the toes were fixed by sewing through the nail phalange by a thick ligature to the back of the foot surface. The defects located at the sole area at some children equal to 2/3 of the foot and were covered by the split skin graft of 0.3-0.4 mm thick (Figures 1 and 2).

To eliminate contractures complicated by ankylosis 13.4% (15 cases) we first removed anklylosis and then restored the functions of extensible apparatus. In overcoming difficult contractures, we used distraction apparatus for the toes. The apparatus was applied by usual method, guiding the pin through the centre of proximal and middle phalanges. Distraction is carried on daily from second day after the operation. The end point of distraction was until mild pain develops in the joint. Distraction is continued up to complete extension of the toe, 25 days on an average. During that time the patient develops passive movements in the joint. In achieving complete extension we try to get certain re-extension. The toe is prepared for tendinous plasty, when passive movements in the proximal inter phalangeal joint are easily performed, edema in the joint area and residual effects of the pins completely disappear.

When there was symphysis of toes I and V of the foot to the plantar surface, combined correction were performed in 19 cases. Stretched soft tissues of the medial surface of digit I or lateral surface of toes V were used to obtain skin-for grafts. The toes were set in the position of moderate hypercorrection. The flap was transferred to the formed wound defect to cover the wound on the plantar surface of the toes. The wound on the lateral surface of the toes was covered with skin grafts (Figure 3).

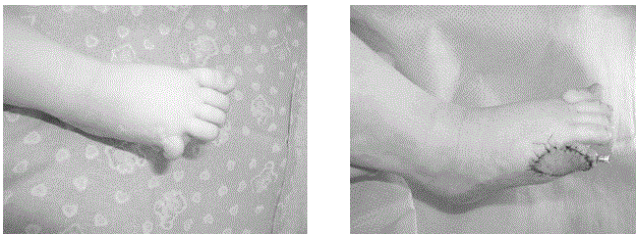

Figure 1: Patient A-pre-operative post burn bent contracture of the V fingers of the right foot IV degree and post-operative result after surgery.

We have observed how Inter-digital symphysis in 32 cases was eliminated by means of local tissues (Pi-form, Z-form, trapezoid or triangular grafts), that made it possible to eliminate flexion contractures of toes and to obtain a cover on the plantar surface which did not interfere with foot development and was stable on exertion during the time of observation. Z-plasty is suitable only in insignificantly marked folds. The optimal anatomically based method is formation of inter phalangeal commissure by trapezoid flap. With this the scarred dorsal leaf was separated from the sole by incision along the crest of the fold.

Figure 2: Patient B-pre-operative post burn bent contracture of the V fingers of the right foot IV degree and post-operative result after surgery.

Figure 3: Patient C- pre-operative post burn bent contracture of I fingers of the right foot III degree and post-operative result after surgery.

Results

As seen from the table, in 79.5% of cases, contracture was removed absolutely, in 14.3% there was an improvement and only in 6.3% of cases there was no improvement because of the irreversible bone-joint changes and others.

Discussion

Burn injuries to the feet are relatively common in young children. Soles of foot burns are often seen in children, and are usually as a result of contact burns. Some patients with deep foot burns are treated with full-thickness or split-thickness skin grafts. In a minority of cases, contracture formation can lead to permanent disability.

In Middle Asia, sandal burns are of special interest. Cases of sandal burns are more frequent during wintertime when people in distant mountain regions use an inappropriate heating system such as the sandal. Characteristics of sandal burns include not only skin injuries but also injuries to underlying tissues.

Functionally, most of the complaints were associated with discomfort related to footwear. When more contractures were involved, apart from footwear problems, difficulties in prolonged walking and pain of the toes joints were common. Post burn deformities of feet soles surface-are mostly the results of contact burn and are difficult to treat.

The high percentage of patients who underwent the post burn bent contracture reconstructive treatment indicates poor effectiveness of conservative methods of therapy used today.

At present some authors offer the tactics of stage by stage treatment of burn deformities, so, first of all the elements of soft tissue a deformity are removed and then at repeat surgery the involvement of bone-joint apparatus is corrected [11-13].

We have worked out the basic principles of treatment of post burn feet deformities, when after incision and removal of scars we tried to remove completely all the elements of deformities in a single stage. This principle allowed us to use more economic surgical intervention on bone-joint apparatus of burnt feet.

For the whole operated feet, it is important to wear long-period fixed plaster cast until the position of contracture is not fully eliminated. That's why we tried to change as often as possible the plaster cast. Fixation by removable plaster cast was done during 3 months period, 3-4 weeks after the operation the patients were recommended paraffin applications, massage and physical training.

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