

Functional Outcome of Post-Burn Upper Limb Contractures in Children

Hasime Terziqi, Shkelqim Derguti, Agreta-Geci-Gashi
Muhammad Mughese Amin, Uzma Naseer, Ammar Akhtar

ABSTRACT

Objective: To analyze the results of surgery and functional assessment in post-burn contractures in upper limbs in children. This evidence implies on how we think the impact of contracture on patients functions in two distant countries, with different cultures, skin colour and socio-economic life in Pristina–Kosovo and Bahawalpur-Pakistan.

Study design: Descriptive case series study in two different countries in cooperation for a joint publication.

Place and duration of study: Department of Plastic and Reconstructive Surgery - Bahawal Victoria Hospital Bahawalpur and Department of Plastic and Reconstructive Surgery- University Clinical Center Prishtine-Kosova, from August 2009 to August 2014.

Methodology: Patients from age 9 months to 17 years with post burn contractures in upper limbs with no metabolic derangement were included in the study. After proper assessment of the functional impairment, X-rays were done and then the surgical decision was made. Different procedures were used for release and coverage of contracture depending on the type of contracture. Patient was called for follow-up up to one year after discharge.

Results: 128 patients were included in study in both countries. 67 were male and 61 were female in B-Pk and 65 male and 63 female in Pr-Ks. Finger contractures are the most common. Best functional improvement was seen in the age group of 9 months to 5 years.

Conclusion: Early surgical intervention results in improvement especially in young children. Type of procedure has no relation with outcome of surgery.

Keywords: Post-burn contracture, reconstruction, joint stiffness, laxity

Introduction:

Pediatric burns are very common and most of them are due to scalding. Following burns there are the possibilities for the development of hypertrophic scars and contractures. Most often the upper limbs get affected in burn accidents. The quality of life depends on the functional capability of the affected limb and as these patients are prone to develop contractures so this could lead to poor

physical appearance of the limb as well as functional impairment. In the upper limbs the hand is the most common site to get burned while the development of axillary contractures are the most difficult to prevent after burns.

As we know that the contractures not only cause disfigurement of the limb but also reduce the functional ability of the limb, may affect activities of daily living, such as grooming, dressing, eating, and bathing, as well as fine motor tasks. The only way to correct this deformity is re-constructive surgery i.e. release of the contracture and then the coverage of the remaining part with the grafts or flaps as required. The full assessment

Dr. Hasime Terziqi

Clinic of pl.S. Prishtine-Ks

Departement of Plastic Surgery, Prishtine, Kosovo

Addres corespodence to Hasime Terziqi MD, Cl.C.Pl. prishtine.

Ulpiana A5-Hy-V, nr-5 . Rruga Selami Pulaha. 10000 prishtine–kosova.

of the affected area and the assessment of the functional impairment is the first step towards the proper surgical treatment. There are different techniques for the re-construction of contracture. But, we have to use those techniques which can prevent further deformity, provide maximum mobility to joints and also look good in aesthetic sense. There are the different problems which a reconstructive surgeon faces during the surgery like shortage of skin, changes in the surrounding structures like tendon shortening or neurovascular changes and joint stiffness. Different techniques are available for coverage after release of contracture like split thickness graft, full thickness graft, local flaps, micro vascular free tissue transfer and Integra artificial skin. Whatever technique we use our main point of concern is maximum aesthetic and especially functional outcome for the patient.

We decided to conduct this study to see the outcome of different surgical techniques in post-burn contractures and to observe the relation of age with the outcome of the surgery in terms of functional improvement. In two distant countries, with different culture, skin color and socio-economic life. Taking the number of patients, their age, location and determining the type of burn contracture.

Methodology:

This was a descriptive case series study carried out from August 2009 to August 2014 in Department of Plastic and Reconstructive Surgery - University Clinical Center Prishtine-Kosova and the Department of Plastic and Re-constructive Surgery, Bahawal Victoria Hospital, Bahawalpur. Patients aged 9 months to 17 years with no

metabolic derangements were included in the study. History was taken and complete physical examination was done.

Functional impairment was assessed properly by checking the range of movement across the joint. X-rays were ordered to see if the joint is also involved in the contracture or not. After proper assessment and x-rays, surgical procedure and probable outcome of the surgery was explained to the parents and proper informed consent was taken. For patients where only skin is involved in contracture, we covered the released portion with split thickness or full thickness grafts. Areas where tendons, ligaments or bones are exposed after releasing contracture, we have to use flap for

the coverage. After surgery patients were kept in ward from 7 days to 3 weeks to monitor for complications. Patients were discharged with the advice for physiotherapy and were called for follow up every week for two months and then they were called monthly for a year to see the functional improvement of the limb.

Results:

Total of 128 patients from each country were included in the study. Their age ranged from 9 months to 17 years with the average age of 11 years.

Different types of contracture we noted in upper limbs after burns and what different types of procedures we used for the coverage after release of contracture. Table I.

Table No. 1 Different sites of contractures and reconstructive procedures used

Site of contracture	No. of patients (percentage)		Procedures performed	No. of patients	
	Pr-Ks	Bw-Pk		Pr-Ks	Bw-Pk
Flexor contractures of fingers	82(64.06%)	56 (43.75%)	Release and full-thickness skin graft	28	30
			Z-Plasty	46	10
			Local and regional flaps	7	16
			Cross finger flap	1	15
Extensor contractures of the hand	5(3.90%)	28 (21.87%)	Release and full thickness skin graft	2	7
			Local advancement flaps	2	6
			Groin flap	1	6
Wrist contractures	7(5.46%)	14	Release and split thickness skin graft	1	4
			Release and full thickness skin graft	1	2
			Radial artery perforator based forearm flap	1	2
			Z-Plasty	1	6
			Abdominal/groin flap	3	4
Elbow contractures	23(17.96%)	18 (14.06%)	Z-Plasty	16	8
			V-Y advancement Flap	5	3
			Release and split thickness skin graft	2	7
Axillary contractures	11(8.56%)	12 (9.37%)	Z-Plasty	5	2
			Release and split thickness skin graft	3	
			V-Y advancement flap	3	

Table No. 2 highlights the complications which we observed after surgery. We observed that whatever procedure we use for

coverage, complication rate is more or less the same.

Table No. 2 Complications in different procedures used for release and coverage

Complications		Split thickness graft	Full thickness skin graft	Local flaps	Z-plasty	V-Y advancement flap	Groin flaps	Radial artery perforator flaps	Cross finger flaps
		Infection	Pr-Ks	2	2	1	1	-	-
	Bw-Pk	2	3	-	1	-	1	-	2
Wound dehiscence in donor site in flap cases	Pr-Ks	-	-	-	-	-	-	-	-
	Bw-Pk	-	-	1	-	1	-	1	-
Donor site hematoma in flap cases	Pr-Ks	-	1	-	1	-	-	-	-
	Bw-Pk	-	-	-	1	-	1	-	-
Partial flap necrosis in flap cases	Pr-Ks	-	-	1	-	1	-	-	-
	Bw-Pk	-	-	1	-	-	-	-	-
Formation of contracture after surgery	Pr-Ks	1	1	1	-	1	-	-	-
	Bw-Pk	-	-	-	-	-	1	-	1

Table No. 3 shows the relation of age with the improvement of functional impairment after surgery and it clearly shows that functional improvement is better in younger children. We assess the aesthetic sense of the coverage on the basis of color and anatomy. We divided the aesthetic outcome of surgery into three categories based on colour i.e. similar colour as the surrounding or excellent, color is nearly

same to the normal surrounding areas i.e. good and no similarity of the colors i.e. poor. 53% cases have excellent results, 28% were good and 18% were poor. We also assessed that to what extent we were able to normalize the anatomy. 73% cases have regained the normal anatomy but in 27% cases we were unable to restore normal anatomy due to joint stiffness.

Table No. 3 Functional assessment after one year of reconstruction with respect to age

Site of contracture	Movements used to assess function	Age Groups Pr-KsB-Pk					
		9 months to 5 years		5 years to 11 years		11 to 17 years	
		Pr-Ks	B-Pk	Pr-Ks	B-Pk	Pr-Ks	B-Pk
Finger contracture	Flexion Extension	All movements were possible to full extent in all patients	All movements were possible to full extent in all patients	Movements are limited in two - three patients out of 14-16 of this age group	Movements are limited in two - three patients out of 15-17 of this age group	8-7 out of 15- 12 patients have limited movements	7-6 out of 15- 12 patients have limited movements
Extensor contracture at MCP joint in fingers	Flexion Extension	Full range of movement in all cases	Full range of movement in all cases	Two patient out of 3-5 has limited movements	One patient out of 3-5 has limited movements	5-3 out of 8-7 patients have full range of movements	5-3 out of 8-7 patients have full range of movements
Wrist contracture	Flexion Extension abduction Adduction	All patients have full range of movement	All patients have full range of movement	All patients have full range of movement	All patients have full range of movement	One out of 4- 4 patients have limited movement of wrist	One out of 4- 4 patients have limited movement of wrist
Elbow contracture	Flexion Extension	All patients have normal movements	All patients have normal movements	2--2 out of 4-5 patients have limited movements	2--2 out of 9-10 patients have limited movements	Only one patient in this age group & has restricted movements	Only one patient in this age group and has restricted movement
Axillary contracture	Flexion Extension Adduction Abduction upto 30 degree than 90 degree then over the head	All cases got full range of movements	All cases got full range of movements	Full abduction over the head was not possible in all 4-3 patients	Full abduction over the head was not possible in all 4-3 patients	Abduction up to 90 degrees or more is not [possible in both patients in this age group	Abduction up to 90 degrees or more is not [possible in both patients in this age group



Fig. 1. (a) flexion contracture after the burn-Pr-Ks



Fig. 1. (b) Radial artery perforator based forearm flap- Pr-Ks



Fig. 1. (c) Two weeks after reconstruction with radial forearm flap - Pr-Ks



Fig. 2. (a) A 15 year old girl with flexor contracture of hand after burn- Pr-Ks



Fig. 2. (b) The contracture was released with "Z" Plasty- Pr-Ks



Fig. 3. (a) A 16 year old boy with extensor contracture of hand after burn



Fig. 3. (b) The contracture was released and the coverage was done with Split thickness skin graft. Patient having normal range of motion



Fig 4. (a): Flexor contracture of fingers after burn



Fig 4. (b): contractures released and full thickness skin grafting done



Fig 5. (a): contractures of little finger. After release tendon was exposed



Fig 5. (b): a cross finger flap is elevated



Fig. 5. (c): post operative picture with good coverage and color match.

Discussion:

Re-construction of a post-burn contracture is a challenge for the surgeon, specially in the cases where tendons, ligaments and joints are also involved in the contracture. A study conducted by S. C Tucker shows that patients with severe post-burn contractures must be treated by the surgeon who has mastered a range of flaps within a setting where physiotherapy expertise are available. A study conducted by Ogwa R and et al shows that free flaps have satisfactory results for the axillary contracture but size, shape, location and depth of contracture must be kept in mind

(4,9) for the selection of surgical method . Askar I conducted a study and shows that double reverse V-Y flap is easy to use when tension across contracture line is too great to use any (5) local flap . Young RC and et al shows that maximum functional improvement is achieved in younger children as joints and (6) tendons have laxity . The study also shows that local flaps have excellent outcomes; free tissue transfer is good in children and Integra artificial skin needs extensive post-operative care and is not easy to use. Study of Stern PJ and et al shows

grafts, flaps and deep releases have equally good to excellent results regardless of the technique we use. Lgnatidis IA and et al shows that distal ulnar and radial artery perforator based flaps have good functional and aesthetic outcome, easy to obtain and cover both dorsal and palmar defects without significant functional deficits or donor site complications.

Our study shows that post-burn contracture in hands are most common as hands are the most common site to be affected by burns as (2.10) depicted by Gupta RK and et al . We noted that even in hands, finger contractures are most common. Results clearly shows that complications have no relation with the type of procedure we use and all types of techniques have fair to excellent results. Size, shape, condition of joints and type of contracture are the most important points to be kept in mind while deciding about the technique because all the methods have comparable results. Development of contracture again after surgery is seen in three-four cases and upon investigation it is revealed that attendants and patients were negligible towards physiotherapy. Functional outcome of the surgery depends on the age of patients and joint mobility and laxity. It is clear that maximum functional improvement is achieved in all cases in age group of 9 months to 5 years. Even in the age group of 5 years to 11 years the results are good, although a very few cases have limited range of movements but the patient was able to do his daily routine. In the age group of 11 to 17 years, 10 out of 27 patients in Pr-Ks & 12 out of 26 patients in B-PK have restricted movements which comes due to joint stiffness and loss of laxity in tendons and ligaments.

It is also observed that maximum normal anatomical correction is obtained when joints are not stiff or involved with the contracture. Colour match of the coverage with the surrounding is 80% in Pr-Ks but in the B-Pk 53% cases have excellent colour match and 18% cases have poor colour match with the surrounding but the people usually get happy if they achieve good functional outcome. With this study we can say that, competency in plastic surgery implies a special combination of basic knowledge, surgical judgment, technical expertise, ethics, and interpersonal skills in order to achieve satisfactory patient relationships and resolution.

This evidence has implications for how we think about the impact of contractures on patient's function. Activities of daily living, instrumental activities of daily living and occupational tasks in children are more affected with upper extremity impairments, there by reinforcing the needs for outpatient therapy after burn injury.

Conclusion:

The patients age and joint stiffness play an important role in the functional outcome of surgery. The age of less than 11 years is good for release of contractures as return of function is maximum in this age group. The type of the procedure has no relation with complications and outcome of the surgery.

References:

1. Williamson MS, Bagley A, Petusky K, Takashiba S, Palmieri T. Analysis of upper extremity motion in children after axillary burn scar contracture release. *Journal of Burn Care and Research*. 2009;30(6): 1002-1006
2. Gupta RK, Jindal N, Kamboj K. Neglected post-burn contractures of hand in children: Analysis of contributory socio-cultural factors and the impact of neglect on outcome. *J ChemOrthop Trauma*. 2014; 5(4):215-220

3. Tucker SC. Reconstruction of severe hand contracture: An illustrative series. *Indian Journal of Plastic Surgery*. 2011; 44(1): 59-67
4. Ogwa R, Hyakusoko H, Murakami M, Koike S. Reconstruction of axillary scar contractures- Retrospective study of 124 cases over 25 years. *Br J Plast Surg*. 2003; 56(2): 100-105
5. Aksar I. Double reverse V-Y plasty in post-burn scar contractures: A new modification of V-Y plasty. *Burns*. 2003; 29(7): 721-725
6. Young RC, burd A. Pediatric upper limb contracture release following burn injury. *Burns*. 2004; 30(7): 723-728
7. Stern PJ, Law EJ, Bedict FE, Macmillan BG. Surgical treatment of elbow contractures in post burn children. *Journal of the American Society of Plastic Surgeons*. 1985; 76(3)
8. Ignatiadis A, Mavrogenis AF, Avram AM, Georgescu AV, Perez ML, Gerostathopoulos NE et al . Treatment of complex hand trauma using distal ulnar and radial artery perforator flaps. *Injury*. 2008; 39(3): 116-124
9. Palmieri TI, Petuskey K, Bagley A, et all. Alterations in functional movement after axillary burn scar contracture : a motion analysis study. *J. Burn Care Rehabil*. 2003; 24:104-8
10. Kowalske KJ, Voege JR, Cromes GF jr., et al. The relation-ship between upper extremity contractures and functional outcome after burn injury |*Abst|Proc AM Burn Assoc* 1996; 28:55.

