

Utilization of Advancement/Local Flaps for the Management of Severe Upper Extremity Burn Contractures

Pankaj Mehrotra

Assistant Professor, Department of General Surgery, Rama Medical College Hospital & Research Centre, Kanpur (UP).

Received: 25-07-2022 / Revised: 20-08-2022 / Accepted: 22-09-2022

Corresponding author: Dr Pankaj Mehrotra

Conflict of interest: Nil

Abstract

Introduction: Severe postburn contractures can lead to partial or total loss of function of the limbs, with devastating socioeconomic and psychosocial impact on the individual, especially in low- and middle-income countries.

Objectives: To analyze all cases of post burn scar contracture and classify axillary contracture based on type and severity with duration of hospital stay, complication rate.

Methods: A retrospective record-based study was done and analyzed data of all patients who have undergone surgery for severe burn contractures of elbow and axilla by means of our technique were retrieved. All patients who had post burn scar contracture (Axilla, elbow, wrist) and who underwent surgical management were included in the study.

Results: In 30 patients (24 female, 6 male) out of this 20 had right side axilla involved and 10 had left side involvement. The mean age of the patient with axilla contracture was 16.4 years (range 3 to 62 years) and there were 7 men (22.6 %) and 24 women (77.4 %). with a mean age of 16.4 years, shoulder range of motion improved significantly from preoperative 111.0° to postoperative 149.4° of abduction-adduction. The elbow range of motion improved from preoperative 76.6° to postoperative 108.6° of flexion-extension, with a significant reduction in the residual elbow contracture from 60.5° preoperatively to 18.5° postoperatively. The average follow-up was 3 months (range, 1.5-7 months).

Conclusions: We conclude that this relatively simple and safe technique limits the risk for early postoperative healing complications and recurrence of the contractures in the long term.

Keywords: Advancement flaps, contracture, burn, skin graft, physiotherapy, V-Y advancement flaps.

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Introduction

Severe contractures of the hand are a common problem for many reconstructive surgeons. A full assessment of the areas affected by the burn and the functional impairment caused is the first step towards providing appropriate surgical treatment [1]. The two main areas that require a concerted effort to regain optimal function are proximal inter-phalangeal joint (PIPJ) contractures and dorsal contractures

involving the Metacarpo-phalangeal joint (MCPJ). Proximal inter-phalangeal joint PIPJ flexion contractures were classified by Stern *et al.* [1] into grades I, II and III. In grade I, the contracture at the PIPJ is correctable by passive flexion of the MCPJ, demonstrating that the problem is entirely limited to skin contracture. In grade II, the PIPJ flexion contracture is partially correctable with passive MCPJ flexion [2].

In this case, the problem may be due to an excessive shortage of volar skin, but is likely to also involve the volar plate and collateral ligaments of the PIPJ to some extent. Here, there is a clearly significant involvement of the volar plate and collateral ligaments of the PIPJ, possibly with an element of actual joint destruction as well [3,4]. In grade I contractures, the surgeon and patient can be optimistic of a good postoperative outcome following surgery that deals with the shortage of volar skin. In grade II contractures, the surgeon needs to be comfortable with the possibility that they may need to release the volar plate and the patient needs to be aware that full extension is not a guaranteed outcome. In grade III, full extension is unlikely and the surgeon needs to be able to make a judgment between full release and joint stability and discuss the option of arthrodesis with the patient. A careful assessment of the lateral slips of the extensor should be made; if they have subluxed volarward following attenuation of the central slip (as in a boutonniere deformity), then they must be addressed with the necessary splinting and/or surgery [5,6].

Materials and Methods

This study is a retrospective analysis of all post burn axillary contractures which were treated with contracture release with split thickness skin grafts and by flaps in the Department of Surgery, from October 2020 to December 2021. All patients who had post burn scar contracture (Axilla, elbow, and wrist) and who underwent surgical management were included in the study.

Exclusion criteria

1. Patients who had previous operative procedure for axillary contracture.
2. Patients who had burns of the elbow and hands.
3. Patients who had post burn axillary contracture less than 3 months.

The severity of axillary contracture was classified into 3 types based on functional restriction as

1. Mild – able to abduct the upper limb above 90 degrees.
2. Moderate – able to abduct the upper limb from 30 to 90 degrees.
3. Severe – able to abduct the upper limb less than 30 degree

Methodology

All patients had been admitted pre operatively and evaluated with proper documentation of the history and clinical findings including the range of motion of the shoulder joint mainly abduction. All the cases were done by single surgeon except 4 cases done by other surgeons. They were all done in supine position with an arm board extension for patients who underwent incision release of scar contracture with split skin grafting. For patients who underwent parascapular flap for contracture release patient were initially put in supine and after contracture release the patient was turned in lateral position for flap elevation and in setting.

Immediate complications of the surgery like graft loss; wound infection and flap tip necrosis were recorded. Functional outcome was measured by noting the degree of shoulder joint abduction achieved. Patient results were classified into good, moderate and poor. All patients were assessed for a period of 1&1/2 years with regular interval at 3, 6, 9, 12, 15 and 18 months.

The compliance of the patient was also classified as poor, moderate and good. Patient who came for 6 follow ups and using splint and doing physiotherapy as per advice were considered good. If the patient comes only 3 visits but continuing physiotherapy without using splints was considered moderate. Poor if patient comes less than 2 visits and not doing any physiotherapy and splints.

Statistical Analysis

Analysis of data was done by using SPSS software ver. 22. Data were statistically described in terms of mean (\pm SD), frequencies (number of cases) and percentages when appropriate. Comparison

of quantitative variables between the study groups was done using Student t test for independent samples if normally distributed. For comparing categorical data, Chi square test was performed. A probability value (p value) less than 0.05 was considered statistically significant.

Results

Table 1: Demographic details with Severity of Patients with Contracture (N=30)

Parameters	Number (%)
Age	16.4 \pm 10.4
Males	6 (22.6)
Females	24 (77.4)
Mild contracture	8 (25.8)
Moderate contracture	18 (58)
Severe contracture	4 (1.6)

As per table 1 the total number of post burn contracture was 31. Out of this 20 had right side axilla involved and 10 had left side involvement. The mean age of the patient with axilla contracture was 16.4 years (range 3 to 62 years) and there were 6 men (22.6 %) and 24 women (77.4 %). The patient demographics of both groups are shown in table. There were 8 cases of mild contracture (25.8 %), 18 cases of moderate contracture (58 %) and 4 cases of severe contracture (1.6 %). The duration of post burn scar contracture of axilla that is the time from the time of acute burns to the time when the patient underwent surgical procedure has a mean year of 3.7 (range from 1 to 30 year).

Table 2: Compliance of Patients

Compliance	Number (%)
Poor	10 (32.6)
Moderate	9 (29)
Good	11 (38.7)

As per table 2 the compliance of the patients in our study was poor in 10 patients that is patient who came for less than 2 visits and who did not do any physiotherapy and did not use splint (32.6 %), moderate in 9 patients that is patient who came for at least 3 visits and were using splint at least 12 hours per day and doing some physiotherapy (29.0 %) and good in 11 patients that is patient who came for 6 follow up visits and were regularly using splint and doing physiotherapy (38.7 %)

Table 3: Surgical Procedure performed after contracture with Complications

Procedure	Elbow Contracture (10)	Axilla (16)	Wrist (4)	p-value
z-plasty	7	9	3	0.11
v-y advancement flap	2	2	1	0.23
Release with skin graft	1	3	0	0.34
Local advancement flap	0	2	0	0.54

As per table 3 different surgical procedure were performed among them the most common was Z-plasty done in 64.5% of

patients followed by V-Y advancement flaps. The axilla contracture was most common done in 52% of cases. But there

was no significant difference in all procedures ($p > 0.05$). There were no major complications in the post operative period. In 5 patients who underwent incision release and split thickness skin grafting had graft loss ranging from 2 % to 10%. For these patients who had graft loss active physiotherapy was delayed till the wound has completely epithelialised or graft has taken well. Usually, it took on the average 2 weeks before the active physiotherapy was started. There were no complications in the remaining 26 patients.

Discussion

In this study of post burn scar contracture of the axilla, on analysis of sex distribution the number of females was higher than males. Compared with other studies the sex ratio is higher in females [7,8]. It may be because in Indian population still the commonest mode of suicide is by self-implicated thermal burns pertaining to dowry related causes [9]. In our study the age distribution was more clustered between 20 and 40 (almost 50%) and the mean age was 26.2 years. In western population studies have shown bimodal distribution that is, it is more common in the extremes of age. In Indian and in under developed countries like Nigeria the age group is more common in the middle age. This variation may be because accidental burns are more common in extremes of ages and suicidal burns are common in middle age group.[10] In western population the cause of burns is accidental when compared to under developed countries where the cause is suicidal in nature. In our analysis of the side involvement right side axilla was more commonly involved than the left side and the reason maybe that dominant hand involvement is always more common since as a reflex it is used to protect for burns [10,11].

In our study the commonest grade of functional limitation is the moderate grade where they can abduct the shoulder joint between 30 to 90 degrees. When we compared the time interval between the

burns and the time when the patient came for treatment, patients who had mild grade came late for treatment (mean 5.63 years) as these patients were able to do all their daily routines without any functional limitation. But patients who had moderate (mean 3.38 years) and severe (1.8 years) grades came for early treatment because of their functional limitation of their daily routines [12,13].

The average difference in hospital stay after flaps and skin grafts was found to be statistically significant in our analysis. The mean hospital stay for skin grafted cases was 13.8 days and that of flap cases was 5.4 days in our study. This shows that flaps are cost effective in terms of hospitalization cost. In poor developing countries where health care setup is not good, flaps are better for contracture release as patients are hospitalized for shorter time and also they can return to their work early when compared to patients who underwent skin grafting after contracture release [14].

In cases where flaps were used for contracture release 5 flap plasty is the commonest method used followed by running Y-V plasty and parascapular flap. The flap type should be selected according to the location and shape of the scar [5]. For single band contractures on the anterior or posterior axillary line, a skin elongation procedure such as Z plasty or running Y-V plasty is selected. The main advantages of these flaps are that they give good lengthening of the scar resulting in good contracture release. These flaps are easy to design, cosmetically has less chance of distortion of axillary hair if properly designed. It has another added advantage that these flaps grow along with the growth of the patient if release is done in the growth spurt age [13-15].

Conclusion

Post burn contracture release with flaps gives very good result in terms of less hospitalization days and good patient compliance although it requires skill and knowledge to choose the right flap for each

contracture type. In our study the results of contracture release with flaps were good with no major complications and it also does not require long term splinting when compared to split skin grafts. In developing countries where patient has to go for work early it is always better to do a contracture release with flap

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