

## Original Article

# Various Methods of Reconstruction of Axillary Burn Contracture

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### Abstract

*Post burn contracture is a burn sequel, which was not properly treated in initial burn management. Deep partial and full thickness burn of axillary region can result in scar contracture which limits shoulder abduction and extension. The axillary contracture has functional morbidity along with aesthetic disfigurement. Difficulties in rehabilitation of shoulder abduction during the initial period and the contractile evolution of the scar contribute to this problem. The goal of the surgical correction of axillary scar contractures is to provide a maximum release with minimum or no local anatomic distortion. 42 patients with post burn contracture of the axillas were operated in the Department of Burn and Plastic Surgery Unit, Dhaka Medical College Hospital and in National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka in the period between November 2007 & December 2011. Among them 26(61.9%) were males and 16(38.1%) were females. Age ranged from 6 to 38 years with a mean age 14.7 years. Unilateral axilla were involved in 34 patients(81%) and bilateral axilla was involved in 8 patients(19%). 18 cases (42.8%) had contracture of anterior axillary fold, 12 cases (28.5%) cases had contracture of posterior axillary fold, 8 cases (19%) had contracture of both folds and 4 cases (9.5%) had contracture involving axillary dome. Pre operative X-ray of shoulder joints of affected axilla revealed normal joint spaces. The operative procedure was chosen according to the pattern of scar and state of surrounding skin. Surgical procedures included release of post burn axillary contracture by reconstructive procedures single Z plasties were done in 2 cases(4.7%), multiple Z plasties were done in 12 cases(28.6%), five flap plasty was done in 1 case (2.4%), local fascio cutaneous flaps were done in 25 cases(59.5%), parascapular flap was done in 1 case (2.4%) and split thickness skin grafting was done in 1 case (2.4%). Axilla was immobilized with plaster cast for two weeks. The rate of complication was 9.5%. All of them were minor. Functional improvement was quite satisfactory, except for one case of skin grafting which had re-contracture. Choice of surgical procedure for reconstruction of post burn axillary contracture can be made according to the pattern of scar contracture and the state of surrounding skin. The choice of a flap should have priority to skin graft because of the superior functional and cosmetic results of flaps. Long term splinting and physical therapy are mandatory to prevent re contracture. Proper pre-operative planning, appropriate surgical method, post operative immobilization, physiotherapy and follow up can make good outcome of post burn axillary contracture reconstruction.*

### Introduction

Axillary post burn contracture is a challenging problem to the reconstructive surgeon owing to the wide range of abduction that should be achieved and due to the common unavailability of local tissues to be used for reconstruction of the axilla. Burn in the axilla even when limited in extent,

may severely limit function. Ill treatment or inadequate splinting and rehabilitation after burn injuries inevitably result in debilitating post burn contractures that impair various functional abilities of the involved limb. Axillary contracture remains a frequent problem due to difficulties of shoulder abduction against the contractile evolution of the scar. Severe axillary contractures may be prevented by early prophylactic splinting and active exercises. Early surgical excision and skin grafting of deep and full-thickness burns will further minimize the development of contractures. The goal of the surgical correction of axillary scar contractures is to provide a maximum release with minimum or no local anatomic distortion. Once surgical correction is intended, the choice of procedure must be individualized. Traditional therapeutic measures include skin grafting, Z plasties and local fascio cutaneous flaps. More recently the free flaps and the island flaps have been reported.

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Axillary contractures were classified by Kurtzman and Stern on an anatomical basis<sup>12</sup>. Proper treatment of axillary contractures can be planned in the light of this classification.

Classification of axillary contractures (Kurtzman and Stern, 1990).

- Type IA : Injuries involving the anterior axillary fold
- Type IB : Injuries involving posterior axillary fold
- Type II : Injuries involving both anterior and posterior axillary folds
- Type III : Injuries involving both axillary folds and axillary dome.

### Patients and Methods

The study was conducted in the Department of Burns and Plastic Surgery Unit, Dhaka Medical College Hospital and in National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka in the period between November 2007 & December 2011. Forty two patients with post burn deformities of the axilla were operated. The age of the patient and the onset of the condition were recorded. Clinical history was taken with special concern on the cause of the burn and the initial management in the acute phase. General examination was done to exclude any medical problem or deformity. All the cases were examined locally for 1) Degree of contracture (=degree of limitation of abduction) whether mild (>90), moderate (30-90) or severe (<30). 2) Site of contracture, whether anterior or posterior axillary folds or both involved. 3) State of the surrounding skin of the adjacent chest, shoulder and arm. Data sheets were maintained where patient's age, sex, involved axilla, degree of contracture, types of burn, methods of surgery, result and complication were recorded.

### Pre operative X-ray

of shoulder joint of affected axilla was taken to see the joint stiffness. Photograph of contracture of affected side was taken preoperatively, preoperatively, on discharge and on follow up. The choice of the operative procedure was determined according to the degree and site of contracture as well as the state of the surrounding skin as follows:

- a) Linear contractures involving either the anterior or posterior folds causing mild to moderate degree of contracture with a good state of surrounding skin: Single or Multiple Z plasty.
- b) Moderate localized contracture band of the anterior or posterior axillary fold with healthy surrounding skin: Local flaps.
- c) Diffuse scarring of the armpit (contracture of one or both axillary folds with scarred surrounding skin) of

any degree: Release and fasciocutaneous flap at armpit and Skin graft on arm or chest wall. The choice was determined according to the state of the surrounding skin for the availability of fasciocutaneous flaps.

All the cases were elective and done under general anaesthesia. Reconstructive procedures were:

- 1- *Single Z plasty*: Z plasty was the procedure of choice for linear scar contractures of the anterior or posterior axillary folds where the surrounding skin was healthy.
- 2- *Multiple Z plasty*: Multiple Z plasties were employed for long linear scars. If one of the defects could not be closed after release, a split thickness skin graft was added to that site.
- 3- *Five flap plasty*: Five flap plasty was done in linear scars with a short web where wide release needed.
- 4- *Local fascio cutaneous flap*: Local fascio cutaneous flaps from arm, anterior chest or back were chosen for cases of localized moderate bands of contractures of anterior or posterior axillary folds or both folds, provided that the donor site is not scarred. Advancement or transposition flaps from the normal uninvolved skin adjacent to the scar were used. The specific design of the flap was dependent upon the distribution and extent of the scar. The donor sites were either in the arm, anterior chest wall or back. Transposition fasciocutaneous flaps were placed over the axillary domes. The donor sites of the flaps were covered by split thickness skin graft.
- 5- *Skin grafting*: Split thickness skin grafting was done after release of contractures of the axilla involving one or both axillary folds. This was done if the surrounding skin is scarred and not available for any local or fasciocutaneous flaps that could cover the resulting defect or if the defect was bigger than any available flap as in severe axillary contractures. Skin grafts were taken from the thigh. Tie-over dressing was placed over the graft to secure it in place. Splinting was done in maximum abduction position.
- 6- *Parascapular flap*: This was the flap of choice to cover the defect after release of the axilla if the width of the defect is less than 8cm provided that the parascapular area is not scarred. The operation is performed in the lateral position. The scar was first released. The width of the defect was estimated, a parascapular flap, based on the parascapular artery, was elevated with dimensions that can cover the resultant defect. The flap was secured in the axilla. The donor site was closed by a split thickness skin graft as the flap wide was more than 8 cm.

Per and postoperative broad spectrum antibiotics were given for all cases for two weeks (intravenous for 5 days). Plaster cast kept for two weeks. Patients were discharged from hospital after two weeks of surgery. Long term splinting and physical therapy were the rule in all the cases. Follow up visits were done after 1 month, 3 months and 6 months from surgery.

### Results

Out of the forty two cases studied, 26(61.9%) were males and 16(38.1%) were females. Patients' age ranged between 6 and 38 years with a mean age 14.7 years. Right axilla was involved in 18 cases (42.8%) and the left was involved in 24 cases (57.1%). Bilateral axilla were involved in 8 cases(19%) and unilateral axilla were involved in 34 cases (81%). The causes of burn were mostly direct flame burn (28 cases=66.7%), and less commonly due to scald burn (14 cases = 33.3%). All the cases gave history of ill treated or minimal physiotherapy or no splinting for axilla. 18 cases (42.8%) had contracture of anterior axillary folds, 12 cases (28.5%) cases had contracture of posterior axillary folds, 8 cases (19%) had contracture of both folds and 4 cases (9.5%) had contracture involving axillary domes. Mean time from initial burn to release was 3 years (range 1 to 8 years). Reconstructive procedures single Z plasties were done in 2 cases(4.7%), multiple Z plasties were done in 12 cases(28.6%), five flap plasty was done in 1 case (2.4%), local fascio cutaneous flaps were done in 25 cases(59.5%), parascapular flap was done in 1 case (2.4%) and split thickness skin grafting was done in 1 case (2.4%). The degree of contracture ranged between mild and severe. The degree of abduction ranged between 20° and 90° with a mean of 60°. The percentage of improvement in abduction in the studied cases ranged from 110 degree to 160 degree with a mean percentage of change in abduction of 140 degree. The degree did not change over the next 6 months of postoperative follow up except in one case from the group who had release and skin grafting i.e. one case of re-contracture.

### Discussion

Burn around the axillary region frequently leads to axillary scar contracture, one of the most difficult problems to prevent in burn patient. Axillary post burn contractures remain a frequent problem after thermal burns involving the trunk and upper arm. Difficulties in rehabilitation of shoulder abduction during the initial period and the contractile evolution of the scar contribute to this problem. Intensive exercise program under physical therapist supervision give the patient the best chance of minimal loss of function. Almost all the studied cases gave history of ill treatment and it was always deep second degree, sometimes complicated

by infection. There were no or minimal physiotherapy and no splinting of the axilla in the acute phase. Many authors stressed the importance of exercises and splinting in burns of the axilla to maintain function and to minimize secondary deformities<sup>2,10</sup>. The cutaneous gliding capacity of the shoulder area skin is important. In addition to the scarring of the fold (s), there are two local anatomic conditions that must be considered in reconstruction: (1) the amount of scarring of the adjacent skin and (2) the involvement of the hair-bearing area of the axilla. Many techniques have been described for the release of contracted scar axilla. Skin grafting is the simplest reconstructive method but it has several disadvantages<sup>[8]</sup>. Free skin grafts are somewhat difficult to apply in the concave surface of the axilla, and after sometime can lead to secondary contracture. Z plasties or local flaps such as transposition or advancement flaps usually can be used in linear scar contractures at the axillary folds, but they are not effective in severe axillary contractures or scarred adjacent tissue. Z plasty is generally the procedure of choice for linear scar contractures. However, a single Z plasty is not suitable in the type II and III axillary contractures, because it requires large skin flaps in a limited area with displacement of the hair bearing area<sup>11</sup>. Local flaps alone or in combination with split thickness skin grafts are helpful in correction of axillary burn scar contractures. The specific design of the flap is dependent on the distribution and extent of scar or the more specifically the availability of normal uninvolved skin adjacent to it. Flaps containing a significant portion of scar tissue particularly at the base of the flap must be avoided<sup>15</sup>. In this study, the operative procedure was chosen according to the pattern of scar. Single Z plasty was done in 2 cases (4.7%), where the contracture was small, linear and placed in anterior axillary fold. In 12 cases (28.6%), the scar was linear contracture of anterior or posterior axillary fold with healthy surrounding skin. Multiple Z plasties were done for these cases. Five flap plasty was done in 1 (2.4%) case in short web in anterior axillary fold. In 25(59.5%) cases, the contractures were moderate localized scars with healthy surrounding skin. Local fascio cutaneous flaps were done for these cases. The flap design and donor site was determined by the shape and location of the scar. Transposition fasciocutaneous flaps from inner or posterior arm were used in localized contracture bands in the posterior axillary fold. Advancement fasciocutaneous flaps from the axilla were used in contracture bands of the anterior axillary fold. Skin grafting was done in 1(2.4%) case where surrounding skin around contracture was so scared that no local or fasciocutaneous flap was available. Fasciocutaneous flaps from back such as parascapular flap has been used for treatment of obliterated axilla. In 1(2.4%) of the studied cases,

parascapular flap was done. The advantage of the parascapular flap is that it is possible to close the donor site primarily and it reconstructs the axillary cavity. The disadvantage of this technique is that it is limited to axillary defects less than 8cm. The functional improvement and the cosmetic result were satisfactory.

Postoperative splinting was done for two months in skin grafted cases. Functional improvement was noticed postoperative but in 1 case re-contraction occurred who did not maintain wearing the splint. Skin grafting is the simplest reconstructive method but it has several disadvantages<sup>8</sup>. Frequently there is a patchy take of skin graft due to the uneven defect, and the prolonged splinting in abduction and postoperative physical therapy are always necessary to avoid additional contraction. Furthermore the cosmetic result after skin grafting is poor. The complications seen in this study were in 4 cases (rate 9.5%); one case of tip necrosis in the multiple Z plasty flap, one case of wound infection, one case of patchy skin graft was not taken (small area) and one case developed re-contraction, who had skin grafted. Apart from the case of re-contraction after skin grafting, the overall functional improvement was satisfactory. The percentage of improvement in abduction had a mean of 140 degree. The aesthetic result was also satisfactory in most of the cases.

#### Conclusion:

The choice of surgical procedure for reconstruction of post burn axillary scar contraction can be made according to the pattern of scar contraction and the state of surrounding skin. The choice of a flap should have priority to skin graft because the functional and cosmetic results of flaps are superior to skin grafting in the axilla. Whenever feasible, Z plasties are always preferred to fasciocutaneous flaps due to simplicity of technique. Axillary dome should be reconstructed by a flap, otherwise there is chance of recontraction. Long term splinting and physical therapy are mandatory after release and skin grafting of axilla to prevent re contraction. Axillary burn contraction can be prevented by proper management of burns in axilla, proper positioning of the shoulder joint, use of abducted split and physiotherapy.

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