



Evaluation of using of square flap in treatment of Postburn Contracture

Dhiaa Jabir Aljuburi¹, Ali Abbar Mazael², Ahmed Khalaf Jasim^{3*},
Tamam Alaa Abdulzahra⁴, Osamah Aldulhasan⁵

Abstract

Background: One of the most common problems that encountered is postburn contracture which has both functional and aesthetic impact on the patients. Various surgical methods had being proposed to treat such problem.

Aim: To evaluate the effectiveness of square flap in management of postburn contracture in several part of the body.

Patients and methods: From April 2019 to June 2020 a total number of 20 patients who had postburn contracture in various parts of their body were subjected to scar contracture release using square flap. The follow up period was ranging between 6 months to 12 months.

Results: All of our patients had achieved complete release of their band with maximum postoperative motion together with accepted aesthetic outcome. All of our patients were quite satisfied of the achieved results we did not encounter any case of complete or partial flap necrosis. No scar contracture recurrence was noticed in all of our patients. **Conclusion:** Square flap is effective method of releasing of scar contracture, it provides simple, easily to learn method of contracture release with both accepted functional and aesthetic outcome with low incidence of recurrence.

KeyWords: square flap, management of Postburn Contracture, aesthetic impact

DOI Number: 10.14704/nq.2022.20.11.NQ66217

NeuroQuantology 2022; 20(11): 2198-2201

2198

Introduction

One of the most devastating injury that person can sustain and yet had hope to survive is the burn. Burn trauma is the second most common cause of death both in developing and developed countries. Burn related injuries are regarded one of major social, economic and public health problem because this attributed to their high mortality and morbidity with long standing devastating disabilities. As more patients now day survive burn injuries, there are increasing focusing to provide these survive peoples with high quality of both function and appearance [1-3]. One of the most common sequences of burn is development of post burn scar contracture which can be regard as inevitable event even with best of treatment, however its incidence is inversely proportional to the initial early burn treatment, and commonly seen in those patients who had failed to

healing care. Management of post burn contracture deformities can be lengthy and complicated process [4-5]. In general there are many surgical options for treatment of post burn contracture these included using simple Z-Plasty, multiple Z-Plasties, V-Y Plasty, V-M Plasty, release and skin graft and various rotational flap with or without grafting [6]. In this study we evaluate the efficiency and the versatility of using of square flap in the treatment of post burn contracture that located in various parts of the body.

Patients and methods

A Prospective study which was conducted between April 2019 and June 2020, were 20 patients with postburn contracture were subjected to contracture release using square flap. Patient's age were ranging between 10 years to 45 years old (12 female versus 8 male).

have adequate initial treatment and adequate post

Corresponding author: Ahmed Khalaf Jasim

Address: ^{1,2}F.I.B.M.S, College of Medicine, Kufa University, ³F.I.B.M.S, College of Medicine, Baghdad University,



^{4,5}F.J.C.P.S/F.A.C.P.S, Alnajaf Teaching Hospital
E-mail: dhiaa75@yahoo.com, alispacetoon2@yahoo.com, ahmedkhalaf72@yahoo.com, tammamalaa@gmail.com, usamaturfi@icloud.com

The anatomic distribution of contracture were as following: anterior axillary fold (4 patients) posterior axillary fold 3 patients cubital fossa 5 patients popliteal fossa 3 patients, groin 2 patients, and first web space 3 patients. All of our patients had more than 6 months post burn contracture who were presented to us with mature, stable scar. We excluded those patients who had immature active scar and those patients who had previously failed surgical intervention of their contracture band. Preoperative patient's assessment and evaluation with history and physical examination. History was focusing on the cause of contracture band, its duration, and any history of patient's surgical intervention. The main complain of our patients was feeling of tightness of the band with limitation of movement, also all of our patients had cosmetic and hygienic concern about their contracture band. Physical examination was focusing on the site of the band, pliability of scar, status of surrounding tissue, degree of joint limitation, and length of the contracture band. Length of the band was measured before and after operation. Preoperative routine investigations were done for all of our patients with preoperative photographs and all of our patients had preoperative informed consent.

Surgical operation

All operations were done under general anesthesia preoperative marking is done before induction of the general anesthesia. First we put the contracture band under maximum stretch to delineate it and then it mark after that we marked our square flap which usually drawn on one side of the contracture band the width of the flap is half of the contracture. The leading of the square flap is located along the contracture band and its base located in normal adjacent tissue then we marked the two adjacent triangular flap which will located on the opposite side of square flap, the angle of first flap (A) is 45 degree while angle of second flap (B) is ranging from 60-90 depending on the pliability of surrounding tissue the bases of these two triangular flap are located in normal tissue opposite to the square flap. After finishing of the marking and following standard procedure for preparing and draping we infiltrated 2% xylocaine with 1:200000 adrenaline along the incision line to secure the haemostatic during operation after

waiting 5-7 minute the operation is begin by incised the contracture band by No. 15 scalpel insuring adequate and fill release of contracture then the square flap and two triangular flap were incised along the previously marked incision. The skin and subcutaneous tissue is incised by using no. 15 scalpel then the flap is raised down to fascia using blunt dissection with caution not to injure the underlying neurovascular structure and maintain adequate flap thickness after releasing of the flaps. The square flap is advanced across the contracture band and fitted to the defect then both adjacent triangular flap (A and B) were transposed on each site of advanced square flap both proximally and distally to it. After securing the hemostatic by using bipolar cautery the flaps are inset into new position and closed in two layers using 3/0 polyglactine running dermal suture and 4/0 polypropylene interrupted suture for skin closure in all of our cases no drain it use the dressing is then done using antibiotic impregnate gauze as first layer then dry fluffy gauze as second layer the dressing is secured in its position using crepe bandage when the contracture band is crossing joint back slab is uses for 7 days post operatively, figure (1).

2199



Figure 1: Surgery procedure

Post-operative management

The patients were kept for one day in hospital and then discharge in next day after dressing is change and the flap is inspected for any hematoma or necrosis. Patients were kept postoperatively on oral antibiotic for five days. At day 7, the back slab is removed. And at day 14 the sutures were

removed. The patients were kept on regular follow up period for 6 to 12 Months postoperatively.

Results

In this study 20 patients with postburn contracture were subjected to contracture band release using square shaped flap. The cause of postburn contracture was flame burn in 12 Cases, Scald in 5 cases, electrical burn in 2 cases, and in one case was due to chemical burn. All of our patients was initially treated conservatively with healing was achieved by secondary intention without using of splint or physiotherapy exercise. All of our patients had reported significant improvement in contracture band with disappearing of tightness of the band across the joint and improvement of range of the movement, also our patient were satisfied in the postoperative appearance with good color and texture match was achieved. For those cases that had axillary contracture, we reported no breaking or distortion of their hair lines. Objective evaluation of the result was also assessed by comparing preoperative and postoperative band length and percentage of gain in length. The preoperative band length was ranging from 5 to 11.5 cm where the postoperative percentage gain in length was ranging from 120 % to 160%. All of our patients had smooth postoperative course with no complication was recorded as flap necrosis, wound infection, wound dehiscence. Only in 2 cases we encountered minor tip necrosis which was treated conservatively with no further sequelae. During our follow-up period which was extended for 6 month to 12 month postoperatively we encountered no case of contracture recurrence.

Discussion

Early and aggressive treatment are important to prevent burn sequelae namely postburn contracture however in spite of adequate initial burn management, normal healing process that follow burn injuries can lead to several deformities. Once the contracture had developed there are several surgical procedure that have been described for correction of these deformity choosing of the surgical procedure will depend on several factors including site of contracture band, width, and status of surrounding tissues [7]. The surgical methods for treatment of postburn contracture include simple vertical incision with transverse closure, contracture release and covering with skin graft, various type of rotational flap - Simple Z-

plasty, complex Z- Plasty, and V-Y Plasties [6]. The most common and versatile method that been widely used for treatment of postburn contracture is using Z plasty and its different subtypes. however, Z- plasty had some restriction and disadvantages as it can lead to shift the anatomical landmark when lengthening of the contracture band, and this not desirable in certain sites, such in axillary hair bearing area as this lead to distortion of the hair line with bad aesthetic result, The actual length gain that can provided by Z-Plasty it depend on its angle and length of its limbs theoretically spearing, when Z-Plasty is design in 90°, this will provided more than 120% gain in lengths however, such angle i-e 90° had limit in transfer of the tissue and can cause much tension during transfer which of course affects the vascularity of the flap , Z-plasty when used for elongation of contracture band this elongation is occur on the expense of shortening on plan 90° from the desired plan. Lastly, when Z-plasty is used for release of the post burn contracture of interdigital web space, it cannot create sufficient interdigital depth, which in such case need additional skin graft or local flap from surrounding area to create sufficient interdigital depth [8-11]. Square flap or three flap Z-plasty was first described by Limberg in 1963, the original design of Limberg square flap was consist of square flap and two-acute angled triangular flap. This original design was later on modified by Hyakusoku and Fumiri were the first triangular flap was 45° and the second triangular flap was ranging from 60°-90 ° depending on the pliability of the surrounding tissues. Square flap first was used for treatment of ear-lobe cleft and cryptotia, later on it was used for Management of post burn scar contractures [12]. Square flap was used successfully in this study for treatment of postburn contracture in various parts in the body and showed very effective scar contracture. Release and elongation with regain joint mobility for those cases were the scar is located across joint. Square flap technique relay on concept of advancement of square shapes flap from normal healthy tissue across the contracture band and transposition of two triangular flap from opposite side of the contracture band to close the defect of released contracture band together with the square flap .Square flap in our study was completely covered the defect without need for any skin graft. It provided the defect with pliable healthy tissue from surrounded area with good color and texture



match. When we used in axillary region, square flap show very little hairline division which was important for aesthetic point of view for those patients. Square shape flap is dynamic procedure, in term we can change the angle of transposition flap according to the surrounded tissue. In those cases were the surrounded tissue is scary and fibrotic, the second transposition flap angle will change to 60° degree to allow tension free closure, since these fibrous tissues will precluded transposition of flap with 90° as this lead tension on closure site. Square shaped flap ending with closure line that not located along the line of previous scar band, this is very Important issue that help to prevent the recurrence of the band, as it was noticed in our study. In our study square flap had offer us gain in length which was ranging between 120% and 160%. In general Square flap can provided 180% gain in length by Simple geometric analysis which mean 2.8 fold of original length of the scar. This mean that square flap had superior length gain when compared with four Z-Plasties (2.12 fold), and six Z-Plasties (2.05 fold). In both 4 and 6 Z-flap the amount of elongation occur on the expense of the incision extension far away from two measured points, while square flap has an excellent extension rate without doing this [13]. Lastly, since the square flap can provided 3-dimensions joint feature, this mean that this flap Can restore normal span of the joint and regain it approximate architecture of the involved joint this of course had both functional and aesthetic advantage added to this aforementioned advantages [14]. Square flap was used successfully by both Kan and Narayan [13] in the management of post burn axillary contracture type I and type II. All their patients were achieved full range of motion postoperatively with good cosmetic outcome and no recurrence.

During follow-up period

Same finding was achieved by Huang and Ogwa [14] where they used square flap in 20 patients with postburn contracture on the axilla (10 cases) and postburn contracture on the first web space (10 cases). They achieved 100% release of contracture with maximum range of motion and web space was greatly improved after using square flap they concluded that using of square flap in web space it lead to fully expand the web space in stereo metric manner, which gives the space a near to original shape and function.

Conclusion and recommendation

Square flap technique showed to be simple, effective way for treatment of postburn contracture in various part of the body. It easily to execute with and with no donor site morbidity. It has good aesthetic outcome especially when used in axilla as it no divided the hair line. Also it can fully span the web space in stereometric fashion, which provided excellent postoperative shape and function.

References

- Goel A, Shrivastara P. Post burn scar and Scar Contracture. *Indian J Plast Surg.* 2010; 43; 563-571
- Dasani H, Kumar AW, Sharma BR. Burns' septicemia-The leading cause of burn mortality. *JPAEMAT.* 2008; 8(2).
- Robert L, Burns S. A practical approach to immediate treatment and long term care, 1st ed., New York, 2012; pp. 95
- Schwar RJ. Management of Postburn contractures of upper extremity. *Journal of burn care and research.* 2007; 28(2): 212-219.
- Saleh Y, El-Shazly M, Adly S, Eloteify M. Management of post burn Mutilated hand Egypt, *J. Plast. Reconstr. Surg.* 2009; 53(1): 101-109
- Alexander JW, Macmillan BG, Martel L. correction of Postburn syndactyly: An analysis of children with Introduction of VM-Plasty and postoperative pressure inserts. *Plast. Recoustr Surgery.* 1982; 70(3): 345-354
- Kreymerman PA, Andres LA, Lucas HD, Silverman AL, Smith AA. Reconstruction of the burned hand, *Plast. Reconstructive Surgery.* 2011; 127: 752-759
- Ertas NM, Küçükçelebi A, Erbas O, Bozdoğan N, Celebioğlu S. Comparison of elongations provided by subcutaneous pedicle rhomboid flap and Z-Plasty in rat inguinal skin. *Plast. Reconstr Surg.* 2006; 117: 486-490
- Karacaoğlan N, Uysal A. The seven flap Plasty, *British Journal of Plastic Surgery.* 1994; 47: 372-374.
- Ertas NM, Borman H, Deniz M, Haberal M. Double opposing rectangular advancement elongates tension line as much as Z-Plasty: an experimental study in the rat inguinal skin. *Burns.* 2008; 34: 114-118
- Bandoh Y, Yanai A, Seno H. The three-square flap method for reconstruction of minor syndactyly. *J Hand Surgery.* 1997; 22(A): 680-684.
- Hyakusoku H, Fumiiri M. The square flap method. *Br Journal of Plastic Surgery.* 1987; 40: 40-46.
- Karki D, Narayan RP. Role of square flap in Postburn axillary contracture. *World J Plast Surgery.* 2017; 6 (3): 285-291
- Huang C, Ogawa R. Three dimensional reconstruction of scar contracture-bearing axilla and digital webs using square flap method, *PlastReconstr Surg Glob open.* 2014; 2: e149; doi; 10.1097/GaX.000000000000110

