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Study of Split Thickness Skin Grafting in Management of Post Burn Contracture

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Abstract

The aim of the study is study outcome of patients undergoing split thickness skin grafting for post burn contracture release. **Material and Methods:** All patients of post burn contracture admitted to medical between August 2013 to December 2015 at Medical College Hospital and Tertiary health care center were included in the study after they satisfy the inclusion and exclusion criteria. **Sample size:** 38 cases. **Conclusion:** Split thickness skin grafting is an simple and effective treatment modality in post burn contracture patients. The success rate split thickness skin grafting in post burn contracture release is 89.5% in our study.

Keywords: Split Thickness Skin Grafting, Post Burn Contracture, Outcome

1. Introduction

Burns related injuries and deaths constitute major public health problems, both in developing as well as the developed world. Burn is the second most common cause of trauma related death after vehicular accidents. An extensive burn is the most devastating injury a person can sustain. Victim of burns always hope to survive, always want to become normal and return to the society as early as possible. It is a challenge to the treating Doctor and his team to fulfill patient's demands.

When the burn wounds heal, the patients may be left with scars having varying degrees of functional and aesthetic components[1–3]. The actual incidence of burns in India is, but the estimated annual burn incidence is approximately 6-7 millions every year[4]. There is a direct relationship between the size of wound and number of contractures in every patient. However, the patients receiving early and standard treatment develop less contracture. A burn patient who receives the best of treatment is expected to heal without any contractures[5]. The extent and magnitude of scarring is directly related to the severity of burn injury.

In a healed burn patient, the healing may have occurred either spontaneously with epithelialization from remnants and contraction from wound margins or over granulation raw areas after spontaneous eschar separation. In all these cases, the scar is immature and measures are taken to allow the scar to mature favourably[6,7]. Except for superficial burn injuries, all burn patients are bound to heal with scars. These scars on the skin are visible to the patient for the rest of his/her life and cause lifelong agony. These may be hypertrophic scar, keloid, hypo-pigmented, hyper pigmented. Approximately 2% of burn scars may turn malignant known as marjolin'sulcer[8]. Burns over neck and joints invariably results in contracture. If proper majors like splintage, traction are taken the contractures can be prevented or its extent can be reduced.

Once contracture is developed it requires some excision and reconstruction by varies methods. Reconstruction is aimed at restoration of active function first, followed by passive function, and finally addressing the aesthetic aspects. Once the priorities of reconstruction have been determined, reconstructive techniques are applied in a hierarchy, as per the reconstructive ladder, starting from the simplest procedure like Split Skin Grafts on the first step to compound tissue transfer by microvascular surgery at the other extreme.

Patients suffering from physical and psychological pain of burn injury and disfigurement are in need of a special level of caring. These patients not only require technical expertise but also a great deal of surgeon's time,

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understanding and compassion. To move patients through process of repair requires mutual trust and respect among patients, their families and the surgeon.

The timing of reconstruction depends on physiological, psychological and socio-economical status of the patient. For both patients and surgeon, realistic expectations are important to the successes of reconstruction.

2. Post-Burn Scar Contractures

A burn patient who receives the best of treatment is expected to heal without any contractures[8]. The incidence of post-burn contractures is extremely high in our country. Quite often, they are not only multiple in a given patient but also very severe and diffuse. The number of trained burn and plastic surgeons is less than 1100 for more than 1100 million populations in India. The patients are treated by a variety of service providers who aim at closing the raw wounds and this leads to invariable development wound contraction and scarring. Patients of post-burn contractures, defects and disfigurements constitute one of the major workload general plastic surgeons, especially the ones in government institutions.

3. Types of Post-Burn Scars

These may be immature/mature, atrophic/hypertrophic/keloid, stable/unstable, depigmented (vitilgo)/hyper pigmented. Approximately 2% of burn scars may turn malignant known as marjolin's ulcer[8]. Except for superficial burn injuries, all burn patients are bound to heal with scars. These scars on the skin are visible to the patient for the rest of his/her life and cause lifelong agony.

4. Skin Grafting

Skin grafting is one of the simple procedure to cover the raw area due to burns. Surgical removal (excision or debridement) of the damaged skin is followed by skin grafting. The grafting serves two purposes: Reduce the course of treatment needed (and time in the hospital) and improve the function and appearance of the area of the body which receives the skin graft.

Skin grafts are used in treating partial thickness and full thickness burns. Early surgical removal (excision or debridement) of burned skin followed by skin grafting reduces the number of days in the hospital and usually improves the function and appearance of the burned area, especially when the face, hands, or feet are involved. However skin grafting is done only when the patients general condition is stable.

There are two types of skin grafts; split thickness skin and a full thickness skin graft. In split thickness skin grafting there is high reliability of graft take even in imperfect recipient bed and it can be meshed to expand surface area. Fenestration allows the tissue fluid to come out and prevents the graft from floating. Re-epithialization occurs by secondary intention and the wound heals. It has disadvantage of poor cosmetic appearance, graft heal with abnormal pigmentation

A **full thickness skin graft** has a better cosmetic appearance but has more chances of graft rejection. For full thickness skin grafts, the donor section will often heal much more quickly than the injury and is less painful than a partial thickness skin graft. The recipient bed for both the types of skin grafts must be well vascularized and should have no bacterial colonization.

Classification of skin grafts according to depth

Name		Thickness (mm)
Split thickness	Thin (Thiersch –Ollier)	0.15 – 0.3
	Intermediate (Blair – Brown)	0.3 -0.45
	Thick (Padgett)	0.45 – 0.6
Full thickness	(Wolfe – Krause)	>0.6

Flap has vascularised block of tissue mobilized from donor side and transferred to another location.

The best skin grafts come from the patient's own unburned skin (donor sites). The grafts (auto grafts) will ideally come from locations that are not ordinarily visible, such as the buttocks or upper thighs, because the donor sites will not be normal in appearance after they heal.

4.1 Aims

- To study management of post burn contracture by skin grafting.
- To study complication in patients undergoing skin grafting for post burn contracture.
- To study outcome of patients undergoing skin grafting for post burn contracture.

4.2 Methods and Methodology

All patients of post burn contracture admitted to medical between August 2013 to December 2015 at Medical College Hospital and Tertiary health care center were included in the study after they satisfy the inclusion and exclusion criteria.

Written informed consent was taken.

Sample size: 38 cases.

4.2.1 Inclusion Criteria

- Burns of minimum 6 months duration.
- Age 18 years and above.
- Contractures of neck, axilla, elbow, knee.
- Contractures secondary to thermal burns.
- Associated hypertrophic scar and keloid.

4.2.2 Exclusion Criteria

- Burns in infants and neonates.
- Contractures of foot, head (eyelid, lip, ear), groin and trunk.
- Contractures secondary to electrical burns, chemical burns.

5. Results

In our study 38 cases underwent post burn contracture release with split thickness skin grafting. Out of the 38 cases 4 cases (10.5%) cases had complication, 2 cases (5.25%) of skin graft rejection, 1 case of knee and 1 case of axillary contracture; 1 case of knee joint contracture developed recontracture and 1 case of neck contracture release with SSG developed keloid.

Patients undergoing knee contracture release with split skin grafting has maximum chances of graft rejection and re-contracture. The contractures occurred mainly due to poor patient compliance. The reason for recontracture is that the burns in this area are usually deep with involvement of underlying tendons.

6. Mode of Presentation

The following table reveals the percentage of cases presented with contractures.

Table 1. Types of contracture and their percentage

Diseases	Total	%
NC	11	28.90%
AC	6	15.78%
EC	9	23.68%
KC	12	31.50%

In our study majority of patients presented with knee contractures 12 (31.5%), followed by neck contracture 11 (28.9%), patients with elbow contractures were 9 (23.68%) and with axilla contractures was 6 patients (15.78%).

Table 2. Age distribution

Contractures	18-30 years	31-45 years	46-60 years
NC	7	4	0
AC	2	2	2
EC	8	1	0
KC	4	6	2

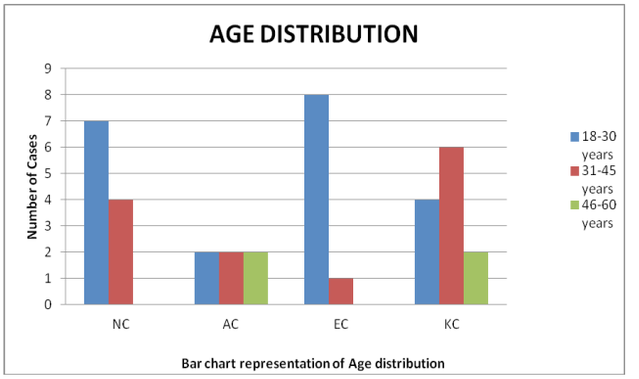

Figure 1. Bar chart representation of age distribution.

In our study the incidence of elbow contracture was maximum with age group of 18-30 (8 cases). Neck contracture was more in age group of 18-30 years (7 cases). The incidence of knee contracture was maximum in 31-45 years (6 cases). Axillary contracture share equal incidence in all the three age group i.e., the 2 cases in each age groups.

Table 3. Sex distribution

Sex	Number of Cases	%
Male	14	36.80%
Female	24	63.20%

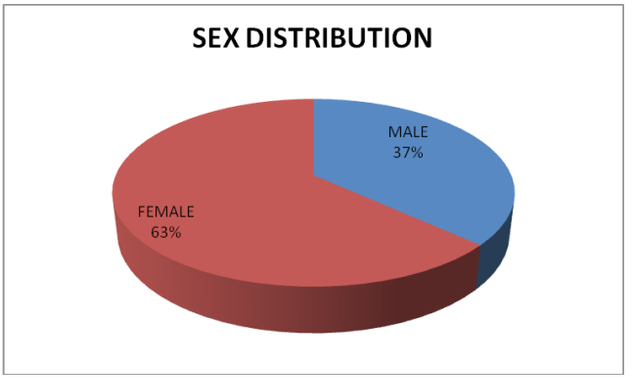

Figure 2. Pie chart representation of sex distribution.

Table 4. Duration of the contracture

Duration of contractures	Neck contracture	Axilla contracture	Elbow contracture	Knee contracture	Total
6m-2 years	3	2	4	6	15
3-4 years	4	3	4	1	12
5-6 years	4	1	1	5	11
Total Cases	**11**	**6**	**9**	**12**	**38**

In our study majority of the patients who presented with contractures were females with 24 numbers of cases and 14 patients were males.

In our study of 3 cases of neck contractures, 2 cases of axillary contractures, 4 cases of elbow contractures and 6 cases of knee contractures are presented between 6months to 1 years; In between 2 to 4 years contracture duration 4 cases of neck contractures, 3 cases of axilla contractures, 4 cases of elbow contractures and 1 cases of knee contracture; contractures presented between 5 to 6 years, 4 cases of neck contractures,5 cases of knee contractures and 1 cases each for axilla and elbow contracture.

Table 5. Intra-operative findings

Intubation	Multi-band	Single-band
Fibreoptic	6	1

Intubation	Multi-band	Single-band
Nasal	4	0

Post burn contracture presents with single or multiple bands most commonly in the neck region presented with difficult intubation. Fibreoptic intubation is done in 7 cases of which 6 cases is having multiband and 1 case is having single band, nasal intubation is done in 4 cases all of them are multiple band neck contractures.

Table 6. Post operative immobilisation

Part Immobilized with	Number of cases
Cevical collar	11
Slab	21
airplane splint	6

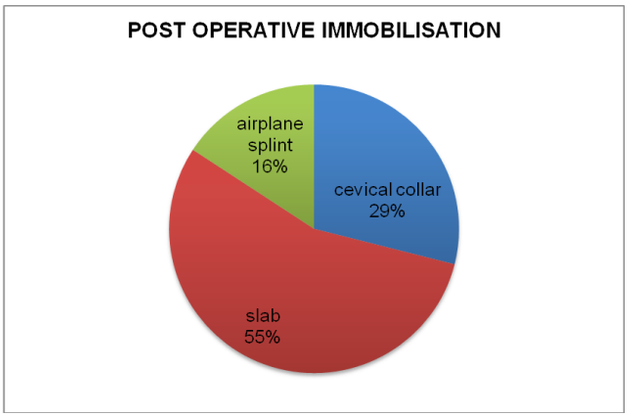

Figure 3. Pie chart representing post operative immobilization.

In our study 11 cases of neck contracture release with split skin grafting neck immobilization done with Philadelphia cervical collar, 9 cases of elbow contracture and 12 cases of knee contracture release with split skin grafting and immobilization done with slab, 6 cases of axillary contracture release split skin grafting done and airplane splint given postoperatively for immobilization.

In our study post operatively physiotherapy was started once the wound was healed, for 10 cases lower limb traction given for knee contracture cases, 11 cases underwent compression garment therapy, 5 cases of both elbow and knee contracture underwent infrared ray's therapy, 8 cases of both neck and axilla contracture has underwent ultrasound therapy.

Table 7. Post operative physiotherapy

Contracture	Compression	Wax therapy	Infrared ray's	Ultrasound therapy	Traction
NC	11	0	0	5	0
AC	0	0	1	3	0
EC	0	5	3	0	0
KC	0	0	0	0	10

Table 8. Complications

	NC	AC	EC	KC
Graft Rejection	0	1	0	1
Recontracture	0	0	0	1
Keloid	1	0	0	0

In our study 38 cases underwent post burn contracture release with split thickness skin grafting with overall 4 cases (10.5%) cases had complication, 2 cases of skin graft rejection 1 cases of knee and 1 of axillary contracture each; 1 case of knee recontracture and 1 case of keloid occurrence in post operative neck contracture release with SSG.

7. Discussion

Post burn contracture is most common complication in the burns patients. It usually occurs in lower socio-economic people. It is often because of patients unwillingness for the treatment or improper treatment. Prevention of contracture is always better. Post burn contracture requires multiple operations to achieve good and aesthetic results. Burns is more common in female than in male same is true for post burn contracture. In our study 38 patients who presented with contractures, majority of patients were females, 24 cases (63%) and 14 patients (37%) were males. Post burn contracture is commonly seen in the 18 -30 yrs age group. Maximum number of patients present to hospital for treatment of contracture from 6 months to 2 years after burns.

The wounds in burn patients heal due to fibrosis to restore physical continuity. Unfortunately, specialized tissue is replaced by fibrosis which produces functional and cosmetic complications. Advances in the care of acutely burned patients have created a challenge to the treating surgeon and an opportunity for the patient. In our study majority of patients presented with knee contractures 12 (31.5%), followed by neck contracture 11 (28.9%), patients with elbow contractures were 9 (23.68%) and with axilla contractures was 6 patients (15.78%).

Burn contractures of the upper limb can produce a significant impact on quality of life by reducing a patient's ability to perform activities of daily living. Appropriate upper limb physiotherapy combined with timely surgical release will give a much more functional upper limb.

More patients survive today with extensive areas of healed burn scar and graft. But most of them have bad scars, keloid and contracture. These patients are challenge to the plastic and reconstructive surgeons. The good thing is that apart from the scars contractures these patients are usually completely healthy and successful reconstructive surgery can often restore them to a happy and productive life. Large series have shown excellent long-term outcomes in even extensively injured patients when compared with normal controls. Patience, persistence, and determination are essential to accomplish successful reconstruction. The skillful application of basic surgical techniques to the reconstruction of post burn deformities can be gratifying to patients and surgeons alike. The ultimate principle of burn reconstruction is learning to understand, appreciate and favorably influence the processes of wound healing and scar maturation.

Greenhalghetal reported 62% success rate with sking rafting. In our study 4 cases have complication out of 38 cases underwent contracture release with split skin grafting with success rate of 89.5%.

Greenhalghetal have shown that early release is not associated with a worse outcome and argues that waiting for maturation of the scar is not necessary[9]. In our study of 38 cases presented to us with contracture of different areas with duration of minimum 6 months to 6 year. In our study of 3 cases of neck contractures, 2 cases of axillary contractures, 4 cases of elbow contractures and 6 cases of knee contractures are presented between 6 months to 1 years; In between 2 to 4 years contracture duration 4 cases of neck contractures, 3 cases of axilla contractures, 4 cases of elbow contractures and 1 cases of knee contracture; contractures presented between 5 to 6 years, 4 cases of neck contractures, 5 cases of knee contractures and 1 cases each of axilla and elbow contracture.

Schwarz *etal* and Joshi as well as Stern et al noted that the completeness of release that can be expected from a procedure depends on the age of the patient, the age of the burn injury, and the severity of the deformity[10]. In our study the incidence of elbow contracture was maximum with age group of 18-30 years (8 cases). Neck contracture was more in age group of 18-30 years (7 cases). The incidence of knee contracture was maximum in 31-45 years (6 cases). Axillary contracture share equal incidence in all the three age group i.e., the 2 cases in each age groups. All underwent surgery contracture release with spilt thickness skin grafting.

Colditz *et al*. has reported excellent results with the use of serial splinting in the stiff joints from a variety of causes with the involved physiotherapist. This therapy technique is time intensive for both patient and therapist, ranging from 4 to 8 or more weeks if the stiffness is long standing. In the postburn knee joint this technique would be of most value after skin release to regain range of motion from stiff joints[11]. In our study post operatively physiotherapy was started once the wound was healed, for 10 cases lower

limb traction given for knee contracture cases, 11 cases underwent compression garment therapy, 5 cases of both elbow and knee contracture underwent infrared ray's therapy, 8 cases of both neck and axilla contracture has underwent ultrasound therapy.

Karki *et al* conducted study on axillary post-burn scar contracture in 44 patients. Surgical treatment included split thickness skin graft in 15 patient. Having partial graft loss in 5 patients and Recontracture in 2 patients, with success rate and outcome without complication is 53.34% [12]. In our study, we have total 6 patients all underwent split skin grafting with 1 case of graft rejection, with success rate and outcome without complication is 83.34%.

Grishkevich VM *et al* conducted study on post burn knee contracture in 58 patients out of which 9 patients underwent wide contracture scar release with skin grafting without complication. Without any sign of ulceration, re-contracture and were functioning well in all terms of observation[13]. In our study overall 12 cases of post burn knee contractures underwent scar excision with split skin grafting with 1 case of partial graft rejection and 1 case of knee re-contracture and outcome without complication is 83.34%.

8. Conclusion

As we have selected post burn contracture release with split thickness skin grafting as a treatment modality for reconstruction of post burn contracture patients. With a success rate of 89.5% is effective treatment modality in post burn contracture patients. Having complication in 4 cases (10.5%). Post operative physiotherapy is helpful to prevent recontracture. In our study of 38 cases of post burn contractures majority of patients were females either due to homicidal, suicidal or accidental thermal burns. Patients presented with knee contractures followed by neck then elbow and axilla contractures.

Prevention of contractures is of utmost importance and is very effective. Early excision of the contracture band and skin cover in the form split thickness skin graft promotes rapid healing and would lessen the risk of contractures. Meticulous post operative splint age, cast, traction, infrared ray's, wax therapy and compression garments of the involved region is essential to prevent contractures. Rehabilitation of a burn patient requires a team should consist of Doctor, nurse, physiotherapist, psychologist and occupational therapist.

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