

Study of Post Burn Contracture of Hand, Surgical Management and Outcomes

Sanjay Sadhu, Bhawna Prabhakar

Abstract

Background: Contractures following burns are a serious sequel impacting functional ability of patient. The impact is more if hands are involved given their importance for daily tasks and earning of livelihood. **Aims:** To study the type of hand contractures in patients after burn injury, surgical procedures done and the outcomes after surgery. **Settings and Design:** Retrospective study was conducted. Records of patients undergoing surgical correction of post burn hand contractures were studied. **Material and Methods:** Patients were classified according to McCauley's classification before surgery. They underwent surgical correction. Different methods were used for wound coverage. In post operative period splints were applied and physiotherapy administered. Patients were again graded as per McCauley classification at the end of one year. **Results:** A total of 35 patients were studied. Of these 19 were male and 16 were female. Ages ranged from one year to 28 years. Single digit involvement was seen in eight patients and both hands were involved in two patients. Methods used for hand coverage were split thickness skin grafting (STSG), full thickness skin grafting (FTSG) and local flaps. Recurrence was observed in two patients. Rest all the patients showed improvement. **Conclusion:** Good functional improvement can be achieved in patients of post burn hand contractures. Skin graft is reasonable method of wound coverage in these patients and flap coverage should be used when skin grafting is precluded. K-wiring is an effective method of splintage in post-operative period. Patients need to be followed up meticulously for proper splinting and physiotherapy.

Key words

Hand contracture, Burns, Skin grafting, K-wiring.

Introduction

Despite advances in prevention and treatment of burns, a sizable number of burn injuries still occur^[1,2]. In spite of best treatment complications follow. One of the important sequelae is scarring because it can lead to gross disfigurement which makes the patient avoid social interaction. If the scarring occurs across joints it results in

contractures with loss of function of the joints. This becomes particularly important if hand involvement is there as hand function is important for activities of daily living and livelihood. Loss of function of both hands cripples the patient.

Proper treatment at the time of burn injury in the form of dressings, splintage, physiotherapy, skin grafting and/

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or flap coverage can prevent formation of contractures. However, once contractures are established, various surgical procedures can lead to restoration of hand function and improvement in quality of life of the patient

McCauley developed classification of burn contractures of hand to categorise the severity of loss of function and the type of contracture^[3]. He divided these patients into 4 categories as follows:

1. Grade I: Symptomatic tightness but no limitation in range of motion; normal architecture
2. Mild decrease in range of motion without significant impact on activities of daily living; no distortion of normal architecture
3. Functional deficit noted, with early changes in normal architecture of hand
 - A. Flexion contractures
 - B. Extension contractures
 - C. Combination of flexion and extension contractures
4. Loss of hand function with significant distraction of normal architecture of the hand
 - A. Flexion contractures
 - B. Extension contractures
 - C. Combination of flexion and extension contractures

The patients in categories 3 and 4 require intervention to restore/improve their hand function.

The present study was based on the patients of post burn hand contractures who presented to our institution and required surgery. The type of contracture, surgery done and the outcome were studied.

Approval was obtained from institutional ethics committee.

Material and Methods

Patient records of all patients who underwent surgery at our institution for post burn contracture of hand from

January 2017 to December 2022 were studied. Patients who were not operated were excluded from the study. After obtaining the history and examining the patients they were categorized according to McCauley's classification. Informed written consent was obtained for all the patients. The surgical procedure performed for the contracture was noted. Patients were followed up after surgery for periods up to one year and finally categorized again. Change in the status was noted.

Results

A total of 35 patients were studied. All of them had suffered thermal burns. Of these 19 were male and 16 were female. The age distribution is given in table 1. The youngest patient was one year old and the oldest patient was 28 years old. Maximum number of patients were in the age of group of less than five years (n=13) showing the vulnerability of young children for these injuries. Only six patients were above 20 years of age. Single digit involvement was seen in eight patients out of whom four had involvement of little finger and four had involvement of middle finger. Rest of the patients (n=27) had multiple digit involvement. Bilateral hand involvement was seen in two patients. Various methods of wound coverage were utilized either alone or in combination. Split thickness skin grafting was done in 24 patients, multiple z-plasties in 13 patients, local flap in six patients and full thickness skin grafting in three patients. Pre-operatively most patients were stage 4a (n=24), nine were stage 3a and one each was stage 3c and 4b. Post-operatively 31 patients were in stage 2, 2 in stage 1, one patient remained in stage 4a as his k-wire had to be removed because of discolouration of the finger indicating vascular compromise and one patient had recurrence and again landed in stage 4a.

Discussion

Burns remain a major public health concern across the world especially in the developing countries^[1,2].

Table 1. Summary of the Patients

S No.	Age(years)	Pre-op grade						Total
		3A	3B	3C	4A	4B	4C	
1	<5	2		1	9	1		13
2	5-10	1			2			3
3	10-15	2			4			6
4	15-20	3			5			8
5	20-25				2			2
6	>25	1			2			3
Total		9		1	24	1		35

Involvement of hands in the burns is markedly detrimental to the patient. Loss of hand function not only affects the livelihood of the person but also affects the activities of daily living. Loss of function of both hands can cripple the patient.

Aggressive management of hand burns at the time of injury helps in prevention of the contractures^[4]. This includes proper dressings, proper splinting, timely surgical intervention/s and proper rehabilitation. Aggressive early physiotherapy has important role in restoration of hand function. Use of silicon sheets and pressure garments improve the aesthetic and functional result. Every effort should be made for prevention of the contractures as treating established contractures is unlikely to yield as good results as primary treatment. However, the patients usually are not fully compliant to the treatment for various reasons. Frequent dressing changes which are painful discourage the patient from following the treatment regimen. Maintaining hand in functional position is a formidable challenge as it involves tight splinting in uncomfortable position which is also painful resulting in patient changing to position of ease thus pre-disposing to contracture formation. Frequently hand burns are part of major burns involving other body parts and affecting overall condition of patient leading to less than optimal treatment of hand burns. In our country financial constraints are major factor for inadequate and compromised treatment. Many patients do not even seek treatment at proper health facility and are treated by quacks^[5].

Once the contractures are established surgery becomes the mainstay of treatment. The timing of the surgery is next consideration. In general, in cases of burns secondary surgeries are usually done after a period of one year as this is the time taken for the scar to mature. In our study we operated most of the patients after establishment of contractures which was primarily because of late presentation of the cases.

Once it has been decided to operate upon the patient the operative plan needs to be formulated^[6]. For this hand needs to be thoroughly examined and tissues involved/ causing the contracture have to be identified. This will ensure that all components of the contracture are released at the time of surgery and optimal restoration of function achieved. Any involvement of fascia, tendons, joints, ligaments, other structures besides scarring of the skin therefore needs to be assessed. Besides, at the time of surgery, the surgeon needs to have an open mind as some unforeseen pathology may reveal itself on operating table

only and the operative plan will have to be modified accordingly.

Proper wound coverage is as important as proper contracture release. Giving a good wound cover without releasing all components of contracture will compromise the results as will improper wound coverage in spite of good contracture release. Various methods of wound coverage including split thickness skin grafting, full thickness skin grafting, z-plasty, local flaps, regional flaps and even free flaps have been used^[7,8]. Dermal substitutes have also been used for coverage in these patients^[9]. For each patient the method deemed most suitable for that particular patient is used.

In our study split thickness skin grafting was used as the method of wound cover in 18 patients. In all the patients graft take was good with good functional recovery. Mann et al have studied the use of split thickness skin grafting in these patients^[10]. They found it to be a satisfactory method. They also compared thin split thickness skin grafts with thick split thickness skin grafts and concluded that the joint mobility after surgery was similar with both. Iwuagwu et al studied the use of skin grafts in post burn contracture release and concluded that they were simple, reliable and safe^[11]. They recommended the use of full thickness skin grafts whenever possible. In our study full thickness skin graft was used in three patients with good results.

Z-plasty (multiple) was used in nine patients in our study to cover the wound. Use of z-plasty has been recommended by Hudson et al in mild contracture where more than 50% range of motion of the joint is preserved and the contracture is in the form of a linear band with pliable skin adjacent to it^[6]. It obviates the need of skin graft if adequate flaps are available. Many variations of the z-plasty have been described^[12].

The exposure of structures such as tendons, bones, vessels, nerves etc necessitate the use of flaps. We used local flaps in six of our patients. The flap was used to cover the vital structures and the residual wound was skin grafted. Ulkur et al have described various flaps used in these patients^[13]. Flap coverage has been recommended by many authors as preferred method of coverage in these patients to prevent the recurrence of contracture. By far local mobilisation of tissue in the form of Z-plasty, V-W plasty, 4 flap plasty etc. has been utilised by various authors for majority of the cases. The other flaps used include local fascio-cutaneous flaps, reverse radial artery flap, posterior interosseous flap, groin flap and in more severe and extensive burns free flaps have been used. In our

study the use of the extensive flaps was not required because of the nature of contractures.

The methods used for wound coverage in our study included split thickness skin graft, full thickness skin graft, z-plasty and local flap individually or in combination. As mentioned previously it has been recommended that flap coverage should be done to prevent recurrence of contractures. In our study we were able to obtain satisfactory results using split thickness skin grafting in majority of patients (Fig 1, 2). Only one patient in our series had recurrence of contracture. Use of flaps can therefore be reserved for patients in whom the wound bed precludes skin grafting or those with recurrence of contractures. However, recurrence may be observed even after flap coverage. Use of full thickness skin grafts in well vascularised beds can be an ineffective alternative to flap coverage.

Proper splinting after surgery is essential^[14]. Splinting may be done by external splints (Plaster of Paris, customized) or internal splinting using k-wires. In our study k-wiring was done in 18 patients (Fig 3, 4, 5). There were no adverse effects noted on joint function after their



Fig 1. Post burn Contracture of Whole Hand

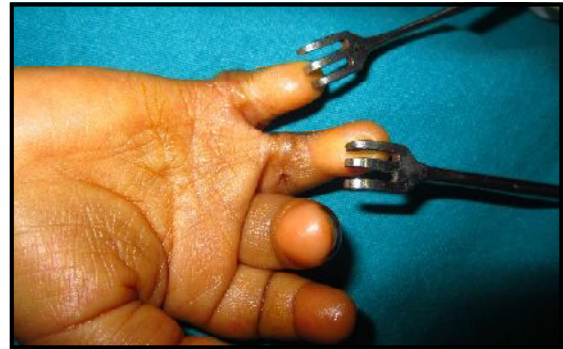


Fig 3: Post Burn Contracture in a Child Involving Little and Ring Fingers



Fig 4: Post Operative Picture of Patient in Figure 3



Fig 2: Post Operative Picture of Patient Shown in figure 1



Fig 5: Patient in Figure 4 after removal of k-wires

removal. Sungur *et al* in their study concluded that k-wires facilitate graft take, prevent recurrence of deformity and do not cause any permanent articular damage^[15]. K-wires are the most effective method of splinting as it does not allow any manoeuvring by the patient and maintain the desired position effectively. Thus, they would be the method of choice in children and patients in whom compliance is anticipated to be an issue.

For adult patients with lesser severity of contractures external splints can be used. Plaster of Paris (POP) splints can be applied at the time of surgery and continued through the period of splintage or can be replaced by customised splints in post-operative period. Alternatively customised splints can be fabricated in advance and applied at the time surgery itself. Splints should be applied at least for a period of three weeks or longer if required. In later post-operative period splints may be applied only at night allowing active movements during daytime. This also facilitates early physiotherapy.

Another important component of the treatment plan for these patients is physiotherapy. Physiotherapy needs to be started as soon as possible. In our study physiotherapy was started at the end of three weeks after surgery when the k-wires were removed or the external splintage was discontinued or only night splints were applied. This is in consonance with other authors^[16]. Aggressive and sustained physiotherapy is essential for good outcome.

Conclusion

We found the use of skin grafts either split thickness or full thickness to be a suitable option for wound coverage in these patients. Local and distant flaps should be used when use of skin grafts is precluded. Combination of various methods of wound coverage can be used in selected patients. For post operative splinting we found that K-wiring is an effective and safe method especially in children. Diligent approach during and after hospital stay is important for favourable outcome.

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