

## TO STUDY THE POST BURN DEFORMITIES AND ITS MANAGEMENT

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### Abstract

**Background:** The aim is to study the Post burn deformities and its management. **Materials and Methods:** This study was conducted on 73 patients with post-burn deformities to evaluate the management and outcomes of various reconstructive procedures. The patients' demographic data, including age and sex, were recorded, along with a comprehensive history of their burn injuries and subsequent deformities. The nature of the burn was categorized into flame, scald, chemical, and other types. The time elapsed since the burn injury was documented, ranging from immediate post-burn to several years later. The types of deformities observed included contractures, keloid/hypertrophic, partial or total loss of structures such as the ear, nose, and eyelids, ectropion of the eyelid or lip, oral commissure deformities, scalp defects (tissue loss or hair loss), and amputations. **Result:** The study includes 73 cases of post burn deformity at various sites which were managed by skin grafting, local flaps and distant flaps. Out of 73 cases involved in the study, 66 cases (90.41%) were due to flame burn, and scald burn also contributed to 7 cases (9.59%). In this study, maximum number of cases were the neck contractures (30.14%) & finger contractures (30.14%). Greater than 3 fingers are released in 4 cases (18.18%). Total number of cases which were operated for keloid/hypertrophic scars were four (5.48%). Total number of cases were two (2.74%). These cases were known cases of epilepsy. They suffered from burn during the Epileptic attack. Amputation was done due to gangrene of fingers. In this study, only three (4.11%) patients developed early complication as graft loss. Two patients required further grafting and one patient's patchy raw area healed spontaneously. In late complication, only two patients developed further contracture and required surgery because they did not wear splintage and had not done physiotherapy as advised to them. Maximum cases are having excellent functional (67.12%) and good aesthetic (75.34%) result. Functional results are assessed in the form of range of motion. **Conclusion:** Flame burns were the most common etiological cause. Maximum cases of neck contractures were severely affected (grade III) and in finger contractures were of type II deformities. Low complication rate; only 3 cases were treated for graft loss, and two required further contracture release. The low complication rate is due to better understanding of autoclaving, anesthetic techniques, magnification, non-adhesive dressing materials and splintage.

## INTRODUCTION

Post burn deformities are more commonly seen in the developing world, as a result of wide spread use of the kerosene stove and an inadequacy of primary and secondary burn care in these vicinities. Reconstruction of severe deformities and keloid/hypertrophic scar following healing of the burn wound confronts the surgeon with some of the most challenging problems in reconstructive surgery.<sup>[1,2]</sup> A thorough knowledge of available

reconstructive techniques, accurate determination of tissue deficiency and secondary distortion, an imaginative planning and meticulous execution of the surgical plan are essential for achieving improvement in post burn deformities.<sup>[3,4]</sup> Various options are available with us to correct post burn contractures. Post burn scarring and contracture resulting in functional limitation and aesthetic disfigurement remains the most frustrating complication of burn wound healing. This study is under taken to review and assess the various methods to correct post burn

deformities mainly contractures.<sup>[5]</sup> The functional and aesthetic results are satisfactory in the overall long-term assessment. This study excludes cases of electrical burns which mainly require amputation in gangrenous limbs or sometimes require skin grafting, post-burn raw areas which require mostly skin grafting and keloid/hypertrophic scar because we were using non-surgical treatment only.<sup>[6,7]</sup> Patients included in this study are from Venkateshwara Institute of Medical sciences (Gajraula) from March 2023 to March 2024. Good surgical judgment is always paramount. In burn reconstruction this is especially true. Many subjective factors come into play- more than with any other field of surgery. Good judgment means the best operation at the best time for the patient. This entails integrating the surgery with the overall rehabilitation effort and establishing priorities. Burn reconstruction is only a part of the overall rehabilitation plan.<sup>[8,9]</sup> A beautiful reconstruction of a patient who is withdrawn from society is a hollow victory. A half-completed reconstruction benefit no one. In initiating burn reconstruction surgery, the surgeon needs to select a winner for the first procedure. An operation that produces a demonstrable improvement in function and appearance demonstrates the value of reconstructive surgery and increases the likelihood the patient will “sign-on” for the long haul. All members of a burn team should participate in the overall reconstruction planning; otherwise, reconstruction degenerates into a series of technical exercises which can achieve only a limited goal. Psychological support, splinting, exercises, and pressure garments all affect the surgical result. A patient must also be included in this planning and understand the surgical objectives.<sup>[10]</sup> Corrective and reconstructive surgery should not be held up as a punishment for noncompliance such as not doing exercises or not using the compression garment or splints. After each surgery, it is important to reevaluate the overall plan and feedback from the patient about the impact of surgery in taking the next step.<sup>[11]</sup> If the goals they had hoped for were obtained, they may be eager to speed up the reconstruction and get on with the next phase as soon as possible. Different priorities exist for children. The classic reconstructive ladder (primary closure, skin grafting, local flap, distant flap, etc.) is helpful but not the sole criterion used for planning a reconstructive procedure in burn deformities.<sup>[12]</sup> If possible, reconstruction is postponed until wounds have matured. Frequently, postponement is not possible if the deformity is progressive or causing a functional deficit. In these cases, reconstruction is initiated early. An example of this might be a severe ectropion of the eyelid.<sup>[13]</sup> This early reconstruction is usually undertaken to correct significant tissue deficiency. In planning, appreciation of this deficiency is important. In fact, the diagnosis of a true tissue deficiency may be the most important step in reconstruction. The surgical plan involves recreating the initial tissue loss and then adding appropriate tissue.

## MATERIALS AND METHODS

This study was conducted on 73 patients with post-burn deformities to evaluate the management and outcomes of various reconstructive procedures. The patients' demographic data, including age and sex, were recorded, along with a comprehensive history of their burn injuries and subsequent deformities. The nature of the burn was categorized into flame, scald, chemical, and other types. The time elapsed since the burn injury was documented, ranging from immediate post-burn to several years later. The types of deformities observed included contractures, keloid/hypertrophic scars, partial or total loss of structures such as the ear, nose, and eyelids, ectropion of the eyelid or lip, oral commissure deformities, scalp defects (tissue loss or hair loss), and amputations. The patients' past medical history was reviewed for any major illnesses or operations that might affect the burn deformities or their treatment. Family history and personal history were also recorded to identify any genetic or lifestyle factors that could influence healing and outcomes. A thorough local examination was conducted to determine the type of deformity, the area involved, and the severity of contractures, categorized as mild, moderate, severe, or extensive. The presence or absence of scarring and the availability of donor sites for grafts or flaps were also assessed.

Routine investigations included hemoglobin levels, urine analysis, blood sugar levels, chest X-ray, and imaging of local parts using X-ray or CT scan as necessary. The management approach was divided into primary and definitive treatments:

### Primary Treatments

- Physiotherapy: Implemented to improve joint mobility and function.
- Pressure Garments: Used to manage keloid/hypertrophic scars.
- Steroids: Administered to reduce scar formation.
- Serial Splinting: Applied to prevent or correct contractures.

### Definitive Treatments

- Release of Contracture and Cover: This included skin grafts, local flaps, Z-plasty, distant flaps, and microvascular flaps.
- Scar Revision: Procedures to improve the appearance and function of scars.
- Excision and Primary Closure or Grafting: Used for managing scar tissue and skin defects.
- Single-Stage or Multiple-Stage Repair: Addressing total or partial loss of structures like the ear or nose, among other deformities.
- Hair Transplantation: Employed for patients with scalp defects resulting in hair loss.

The study monitored potential complications such as graft loss, partial or total flap necrosis, infection, hematoma, and wound dehiscence. Outcomes were evaluated from both functional and aesthetic perspectives. Functional outcomes included improvements in joint movement and overall

mobility, while aesthetic outcomes focused on the cosmetic appearance of the reconstructed areas. Patients were followed up periodically to monitor the long-term success of the treatments, manage any late complications, and assess overall patient satisfaction with the functional and aesthetic results of their reconstructive surgeries.

## RESULTS

The study includes 73 cases of post burn deformity at various sites which were managed by skin grafting, local flaps and distant flaps. The following observations were made.

**Table 1: Sex Distribution.**

Sex	No. of Cases	Percentage (%)
Male	25	34.25
Female	48	65.75
Total	73	100%

The male to female ratio in this study is 1:1.92 (females are nearly double in this study)

**Table 2: Age Distribution**

Age in yrs.	No. of Cases	Percentage (%)
0-10	14	19.18
11-20	28	38.36
21-30	20	27.39
31-40	7	9.59
41-50	3	4.11
>50	1	1.37
Total	73	100%

In this study, maximum cases were found in age group of 11-20 years i.e.28 (38.36%). One case was above 50 years.

**Table 3: incidence of post-burn deformities at various sites.**

Period	Total No. of Admissions	Total No. of Post Burn Deformities
March.2023 to March. 2024	293	73

The total number of admissions to Venkateshwara Institute of Medical sciences (Gajraula) from March 2023 to March 2024 is 293. Among these the post-burn deformity at various sites were to 73 cases (24.52%).

**Table 4: frequency according to nature of burns.**

Nature of Burns	No. of Cases	Percentage (%)
Flame	66	90.41%
Scald	7	9.59%
Total	73	100%

Out of 73 cases involved in the study, 66 cases (90.41%) were due to flame burn, and scald burn also contributed to 7 cases (9.59%).

**Table 5: site of contracture release.**

Site	No. of Cases	Percentage (%)
Neck	22	30.14
Axilla	12	16.44
Elbow	3	4.11
Finger	22	30.14
Knee	1	1.37
Toe	2	2.74
Palm	2	2.74
Dorsum of foot	1	1.37
Ectropion	2	2.74
Total	67	91.78%

In this study, maximum number of cases were the neck contractures (30.14%) & finger contractures (30.14%). Contractures were least in knee, eyelids and dorsum of foot.

**Table 6: frequency of severity of neck contracture.**

Severity	No. of Cases	Percentage (%)
Mild	4	18.18
Moderate	5	22.73
Severe	10	45.45
Mentosternal	3	13.63
Total	22	100%

Maximum cases were severely contracted (10 cases- 45.45%). Mentosternal contracture of the neck was seen in 3 cases (13.63%). In patients who were not compliant in wearing a brace, the best result was obtained by using a full thickness skin graft at the release site. In our study, out of 22 neck contractures, all patients underwent split thickness skin graft. Two patients had graft loss of 4-6 cm which was treated by regrafting with split thickness graft, other patient showed excellent result.

**Table 7: frequency of finger contracture**

No. of Fingers	No. of Cases	Percentage (%)
One	4	18.18
Two	9	40.90
Three	5	22.73
Greater than three	4	18.18
Total	22	100%

Maximum cases are 2 fingers contracture (40.90%). Greater than 3 fingers are released in 4 cases (18.18%).

**Table 8: frequency of type of finger contracture**

Type	No. of Cases	Percentage (%)
I	5	22.73
II	13	59.09
III	4	18.18

Maximum number of patients were from type II deformity (59.09%). In our study, 22 finger contractures were released, 5 cases were in type I deformity, 13 cases were in type II deformity and 4 cases were in type III deformity. Total number of cases which were operated for keloid/hypertrophic scars were four (5.48%). Total number of cases were two (2.74%). These cases were known cases of epilepsy. They suffered from burn during the Epileptic attack. Amputation was done due to gangrene of fingers. In this study, only three (4.11%) patients developed early complication as graft loss. Two patients required further grafting and one patient's patchy raw area healed spontaneously. In late complication, only two patients developed further contracture and required surgery because they did not wear splintage and had not done physiotherapy as advised to them.

**Table 9: duration of splintage**

Post-op. period(months)	No. of pts. with splint	No. of pts. without splint
3	65	8
6	40	30
12	21	40

In our study, patients were advised to wear pressure garments and splints for maximum period and also advised to do physiotherapy. The numbers of patients followed for 6 months was 70 cases (95.89%). The results among these are evaluated as shown in table 9. While the use of splints and continuous pressure garments across the joints has been effective in minimizing hypertrophy, scar contracture and recurrence of contracture, the true efficacy remains undefined.

**Table 10: patients perception of results.**

Functional Result	No. of Cases	Percentage
Excellent	49	67.12
Good	14	19.18
Poor	10	13.7
Aesthetic Result	No. of Cases	Percentage
Excellent	10	13.70
Good	55	75.34
Poor	8	10.96

Maximum cases are having excellent functional (67.12%) and good aesthetic (75.34%) result. Functional results are assessed in the form of range of motion.

## DISCUSSION

In this study, maximum cases were found in age group of 11-20 years i.e.28 (38.36%). One case was above 50 years. In study conducted by Dias AD maximum number of cases were in age group of 21-40 year (13 cases) and sex distribution was equal.<sup>[14]</sup> Maximum cases were severely contracted (10 cases-

45.45%). Mentosternal contracture of the neck was seen in 3 cases (13.63%). EL-Otefy M.A,<sup>[15]</sup> studied 158 patients (48 male and 110 female) whose aged from 11/ 2 to 60 years. The study includes neck contractures (56 patients), axillary contracture (17 patients), elbow, finger, groin and popliteal space (83 patients), and pre patellar scar (2patients). 125 patients out of 158 patients treated by X-plasty and

skin grafting. The technique used is X shaped incision rather than linear incision. The two 'V' shaped flaps separated by transverse incision may be joined by a vertical component, if the local condition warrants it. The study showed consistently satisfactory results and only two contractures required revision. In our study X-release was used in only three contractures (i.e. axilla) with good result. J.P. Waymack,<sup>[16]</sup> in review of 143 neck release procedures in children performed at the Cincinnati Shriners Burn Institute, found recurrence rate of 62% in patients released with split thickness skin grafts. The use of neck hyperextension brace for over 1 year following skin graft decreased the recurrence rate to 17%. In patients who were not compliant in wearing a brace, the best result was obtained by using a full thickness skin graft at the release site. In our study, out of 22 neck contractures, all patients underwent split thickness skin graft. Two patients had graft loss of 4-6 cm which was treated by regrafting with split thickness graft, other patient showed excellent result. Maximum number of patients were from type II deformity (59.09%). Stern et al studied 264 cases of post burn proximal interphalangeal joint flexion contractures in children. A classification system on the basis of contracture severity was devised to assess efficacy of treatment. 156 cases were in type I deformity, 94 cases were in type II deformity and 14 cases were in type III deformity. Release and FTSG was used in 74 cases, Z-plasty in 34 cases, cross finger flap in 7 cases and fusion in 7 cases.<sup>[17]</sup> The study showed that 88% of the digits were successfully treated (post operative contracture less than 20%). Unsatisfactory results (12% of digits) were directly proportional to severity of the contracture and tended to occur in older children. In our study, 22 finger contractures were released, 5 cases were in type I deformity, 13 cases were in type II deformity and 4 cases were in type III deformity. In our study, patients were advised to wear pressure garments and splints for maximum period and also advised to do physiotherapy. The numbers of patients followed for 6 months was 70 cases (95.89%). The results among these are evaluated as shown in table 9. While the use of splints and continuous pressure garments across the joints has been effective in minimizing hypertrophy, scar contracture and recurrence of contracture, the true efficacy remains undefined. In study done by Haing T.T. et al,<sup>[18]</sup> (625 patients), they showed that use of splints and pressure garments for 6-12 months has reduced the percentage of patients (to 23.2%) requiring release operation. The incidence decreased further (to 15.3%) for those who had faithfully worn the appliances for longer than 12 months. In our study, 40 (54.8%) patients continue to wear splints and pressure garments for 6 months and 21 cases (28.77%) continue to wear splints and pressure garments for one year.

## CONCLUSION

Flame burns were the most common etiological cause. Maximum cases of neck contractures were severely affected (grade III) and in finger contractures were of type II deformities. Low complication rate; only 3 cases were treated for graft loss, and two required further contracture release. The low complication rate is due to better understanding of autoclaving, anesthetic techniques, magnification, non-adhesive dressing materials and splintage. Long – term splintage and/or pressure garments were required for split thickness grafted patients and the time was remarkably decreased when using the local and distant flap.

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