

Study of Demographic Factors and Management Modalities of Post burn contracture Finger

M. F. Shaikh¹, Rutvij Parikh², Dhruven Desai³

¹Professor, Department of Burns and Plastic Surgery, B. J. Medical College, Ahmedabad, Gujarat, India, ²Assistant Professor, Department of Burns and Plastic surgery, AMC MET Medical College and Sheth L. G. General Hospital, Ahmedabad, Gujarat, India, ³Senior Resident, Department of Burns and Plastic Surgery, B. J. Medical College, Ahmedabad, Gujarat, India

Abstract

Background: Burns constitute the second highest incidence of trauma-related deaths globally, second only to vehicular trauma both in developed and developing countries. Once a patient has been resuscitated, efforts are then made to improve wound healing to prevent scarring and contractures as contractures lead to a loss of function, poor cosmetic outcome, and reduced quality of life, pain, and psychological consequences. Contractures of the upper extremities may affect activities of daily living, such as grooming, dressing, eating, and bathing, as well as fine motor tasks. As burn survival rates have increased significantly in the past few decades, it is important to shift the focus on preventing and treating contractures.

Materials and Methods: This multicentric prospective comparative study was carried out on patients of the Department of Burns and Plastic Surgery, Civil Hospital and B. J. Medical College, Ahmedabad, and Sheth L. G. General Hospital, Ahmedabad, India, from December 2013 to December 2015. A total 51 adult subjects (both males and females) all the patients presenting to the outpatient department of both centers with post-burn contractures fingers or indoor patients developing contractures during their stay for the treatment of acute burns in the aforementioned time frame were included in the study. The data were collected with a pro forma regarding patient, defect, and treatment-related parameters. All the details of the patient that were relevant to the study were collected during the pre-operative, surgical, and post-operative periods and during follow-up which was later analyzed.

Results: Maximum number of the patients belonged to 21–30 years age group with almost equal sex preponderance. Most patients had flame burns (78%), 23 patients had total body surface area (TBSA) 10% or less, and mean TBSA was 13.43%. In total, 27 patients were neither advised physiotherapy nor splinting was done while 68.6% had a single finger contracture. Of total, 33.3% of patients presented between 1 and 2 years after burns. All patients belonged to either Grade 3 or Grade 4 contracture. Out of total, 64.2% of patients underwent contracture release with standard treatment guideline with very few complications of all modalities of treatment.

Conclusion: Female being involved in the activities such as cooking and outdoor work is mostly exposed to hazards of flame burns. Most of the patients were from rural setup, the lack of regular follow-up and subsequent absence of preventive measures can be attributed to the causative factor for contractures. Flame burns being deeper have more propensities for development of contractures. Length of stay, total burnt surface area, and lack of physiotherapy and splinting were found to be statistically important predictors for the presence of contractures. Rehabilitative strategies and preventive methods have not gained popularity despite widespread prevalence of post-burn contractures. Split-thickness grafting was the most common performed procedure followed by full-thickness grafting followed by local flaps. Most common complication in our series was wound infection and partial graft loss.

Key word: Contracture, Full-thickness skin grafts, Local flap, Post-burn contracture finger, Standard treatment guideline

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INTRODUCTION

Burns constitute the second highest incidence of trauma-related deaths globally, second only to vehicular trauma both in developed and developing countries.^[1] The most common mechanisms of injuries are scald and flame burns, accounting for 45% and 20% of

Corresponding Author: Dr. Rutvij Parikh, 201, Atulyam 8, Superspeciality Resident Quarters, Ghoda Camp Road, Meghani Nagar, Asarwa - 380 016, Ahmedabad, Gujarat, India.

burn injuries, respectively. Flame burns usually result in an increased depth of burn. Chemical and electrical burns are less prevalent (<10%).^[2] Once a patient has been resuscitated, efforts are then made to improve wound healing to prevent scarring and contractures as contractures lead to a loss of function, poor cosmetic outcome, and reduced quality of life (QOL), pain, and psychological consequences.^[3,4] Contracture is abnormal deposition and maturation of collagen, which leads to hampering of function of joint or soft-tissue structure and cosmetic disfigurement or both. Contractures can be intrinsic or extrinsic. Intrinsic contractures result from injury or loss of tissue in the affected area, causing distortion and deformity of the part. Extrinsic contractures occur when tissue loss at a distance from an affected area creates tension that distorts the structure. Individuals with burn injuries are at risk for developing contractures due to multitude of factors. Patients with burns often are immobilized, both globally, as a result of critical illness in the severely burned, and focally, as a result of the burn itself because of pain, splinting, and positioning. Contractures interfere with skin and graft healing. Functionally, contractures of the lower extremities interfere with transfers, seating, and ambulation. Contractures of the upper extremities may affect activities of daily living, such as grooming, dressing, eating, and bathing, as well as fine motor tasks.^[5,6] As burn survival rates have increased significantly in the past few decades, it is important to shift the focus on preventing and treating contractures.

MATERIALS AND METHODS

This multicentric prospective comparative study was carried out on patients of the Department of Burns and Plastic Surgery, Civil Hospital and B. J. Medical College, Ahmedabad, and Sheth L. G. General Hospital, Ahmedabad, India, from December 2013 to December 2015. A total of 51 adult subjects (both males and females) all the patients presenting to the outpatient department of both centers with post-burn contractures fingers or indoor patients developing contractures during their stay for the treatment of acute burns in the aforementioned time frame were included in the study.

Study Design

This was a prospective observational study.

Study Location

This was a tertiary care teaching hospital-based study done in the Department of Burns and Plastic Surgery, Civil Hospital and B. J. Medical College, Ahmedabad, and Sheth L. G. general hospital, Ahmedabad, Gujarat, India.

Study Duration

The study duration was from December 2013 to December 2015.

Sample Size

Fifty-one patients.

Inclusion Criteria

1. Patients with post-burn contracture of hand were included in the study.
2. Limitation in the range of motion in at least one plane of motion at a specified joint was considered to be a contracture at that joint.

Exclusion Criteria

The following criteria were excluded from the study:

1. Patients refusing for treatment.
2. Patients with contractures due to any other etiology other than burns.
3. Joint stiffness.
4. Acute infective condition.

Procedure Methodology

Collection of data

The data were collected with a pro forma regarding patient, post-burn contracture, and treatment-related parameters. All the details of the patient that was relevant to the study were collected during the pre-operative, surgical, and post-operative periods and during follow-up which was later analyzed.

Procedure

Both informed and written consent were taken about the procedure and the study on a preformed format. All the included patients were subjected to detailed history taking including demographic data (age, sex, and ethnicity) with special attention to length of hospital stay, length of intensive care unit stay, presence of concomitant medical problems (defined as medical problems that might alter the course of recovery from the burn, e.g., diabetes, chronic obstructive pulmonary disease, heart disease, and asthma), burn etiology, inhalation injury, neuropathy, amputation as the result of the burn injury, and total burnt surface area and total grafted area. A detailed general examination with importance to anemia and nutritional deficiencies was carried out. Local examination of contractures at all the joints was done and recorded. The joints of interest included the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints of finger. The subjects' active range of motion at each joint was measured using a goniometer with a standardized technique. Multiple planes of motion (i.e., flexion/extension) were investigated at each joint and the extent of functional and/or cosmetic impairment was recorded. A clinical photograph of the

contracture was then taken. Investigations with respect to preoperative fitness such as complete blood count, renal function tests, serum proteins, liver function tests, chest X-ray, and electrocardiogram whenever necessary were done in addition to local part X-ray. The classification of Sheridan and McCauley for the hand was modified for the current study involving all sites with contractures. This classification is useful for assessing function and physical management of contractures.

Patients with contractures belonging to Grade I and Grade II did not require surgery. They underwent manipulation under anesthesia and/or regular physical exercises at the physiotherapy department to regain full function. Patients with contractures in Grades III and IV of this modified classification had surgical release of their contractures. The defect was repaired using a technique appropriate for the site involved like incision or excision of contractures with skin grafting or local flaps. Postoperatively, patients were splinted using Plaster of Paris splints which were later replaced by thermoplastic splints and were started with physiotherapy within a span of 3 weeks to maximize function.

Follow-up procedure

Patients were followed up for 6 months following discharge and details pertaining to long-term complications, recurrence, and compliance with physiotherapy were noted. Patients discharged after September 2015 which followed up till February 2016.

Assessment of outcome

Statistical analysis was done using SPSS software (Statistical Package for the Social Sciences). Logistic regression model was used to find the predictors for the presence of contractures and various descriptive statistics were used to calculate frequencies, percentages, and means.

RESULTS

Demographic Factors

In our study, we studied 51 patients of post-burn contractures between the period of December 2013 and December 2015. Post-burn contractures were present in all age groups with the youngest patient being of 3 years while oldest was of 54 years. Maximum number of the patients belonged to 21–30 years age group (33.3%). Post-burn contractures were seen almost equally in or study with a slight preponderance toward the female gender. The mean distance from the treating hospital was 77.72 km.

Factors Related to Burn Injury

In our study of the 51 patients, most of the contractures were caused by flame burns (78%) while scald burns

accounted for 5 (10%) patients and electric burns accounted for 6 (12%) cases. Of the 51 patients included in the study, 23 patients had total body surface area (TBSA) 10% or less while 14 patients had TBSA between 11 and 20%, 10 patients belonged to 21–30% while three patients had TBSA 31–40%, a single patient in 41–50%, and another single patient had more than 50% total burnt surface area. The mean TBSA was 13.43%. Of the 51 patients included in our study, 27 patients were neither advised physiotherapy nor splinting was done while 10 patients were given splinting and 8 patients were given only physiotherapy. Only six patients were advised both physiotherapy and splinting.

Factors Related to Contractures

Contracture frequency

Of the 51 patients, 35 patients (68.6%) had a single finger contracture, 11 patients had 2 finger contractures (21.6%), 3 patients had 3 fingers contractures (5.9%), and 2 patients had more than 3 fingers contractures (3.9%).

Duration between injury and time of presentation

Of the 51 patients included in the study, 9 patients presented within a year of burns while maximum (17 patients – 33.3%) presented between 1 and 2 years, those presenting between 2–3 years and 3–4 years were 12 and 5, respectively, and 8 patients presented after 4 years. The mean duration of presentation was 36.4 months.

Distribution according to classification

Of the 51 patients that were included in the study, 23 patients were in the Grade III of Sheridan and McCauley classification, that is, they had contractures which were functionally limiting with early changes in the normal architecture while 28 patients had Grade IV contractures, that is, there was loss of joint function with significant distortion of normal architecture. None of the patients belonged to Grades I and II.

Predictors of contracture formation

On subjecting the data of our study to statistical analysis for calculation of odds ratio and logistic regression with 95% confidence interval, it was found that of the parameters such as age, sex, length of stay total burnt surface area and absence of physiotherapy and splinting, length of stay ($P < 0.05$), total surface area burnt ($P < 0.05$), and lack of physiotherapy and splinting were statistically significant factors in predicting contracture formation.

Parameter	Odds ratio	P value
Age	0.976	0.018
Sex	0.722	0.056
Length of stay	1.056	0.000
TBSA burnt	1.032	0.003
Absent physiotherapy and splinting	1.044	0.000

Procedure	No. of procedures	Percentage
Split-thickness skin grafting	34	64.2
Full-thickness skin grafting	10	16.9
Local flap	07	3.8
Total	51	100.0

Out of the 51 patients in our study, wound infection and partial graft loss were among the most common complication which was seen in total two patients each, followed by flap tip necrosis in one patient and in follow-up of 6 months only one patient had recurrence of contracture which required reoperation. Out of 34 patients operated for contracture of finger with release + standard treatment guideline, one patient had wound infection, one patient had partial graft loss, and one patient had recurrence. Out of 10 patients operated for contracture of finger with release + full-thickness skin grafts (FTG), one patient had wound infection, and one had partial graft loss. Out of seven patients operated for contracture of finger with release and local flap, only one patient had tip necrosis of flap.

DISCUSSION

In our study, most patients were relatively young. This age group being the working class and involved in the activities like cooking is mostly exposed to hazards of flame burns. The socioeconomic implications of such disabling conditions are even more devastating given the economically productive age of the victims. Several published studies have described a similar frequent involvement of younger individuals. The incidence of burns and its sequel, the post-burn contractures are almost equal in both the genders. The female preponderance can be attributed to the fact that flame burns sustained during cooking due to unsafe modalities of cooking like *chulha*, kerosene stoves are still rampant in lower socioeconomic classes. Despite the advances in medical sciences and multiple initiatives taken by the government, there still remains a dearth of quality health care available at affordable prices in the periphery of major cities. The fact that an average patient had to travel for more than 70 km for the management of a functionally debilitating disorder exemplifies this fact. Furthermore, the lack of regular follow-up and subsequent absence of preventive measures can be attributed to long distances.

In a study carried out by Schneider *et al.*^[7] for 985 patients, flame burns formed 61%, scald burns 7%, and electrical burns formed 9%. Flame burns by far are more common cause of burns as compared to scalds and electric burns. Flame burns are deeper and thus have more propensities for the development of contractures as compared to scald burns. In a study carried out by Schneider *et al.*,^[7] burnt

surface area (TBSA) was 25.1% while in Saaq *et al.*,^[8] the mean TBSA was 15.49% which was consistent with the result of our study with mean TBSA was 13.43%. In the study carried out by Saaq *et al.*,^[8] they have reported that none of the patients in their study had received splinting or physiotherapy. Despite widespread prevalence of the problem of post-rehabilitative strategies and preventive methods have not illiteracy, poor health-care facilities, and lack of compliance on compounded the impact. In our study out of the 51 patients, 35 patients (68.6%) had a single finger contracture. Due to proximity of joints in the upper limb, particularly the hand and involvement of multiple joints in patients with higher total burnt surface area; multiple joints can be involved in contracture formation. In our study, maximum (17 patients – 33.3%) presented between 1 and 2 years. In a study carried out by Saaq *et al.*,^[8] the mean duration between injury and presentation was 4.6 years. Rural population, illiteracy, and lower socioeconomic status can be considered as the contributory factor for long duration between injury and presentation.

Maximum patients with contractures were from Class 3 (45.1%) and Class 4 (54.9%). Most of the patients belonged to the group where there was a loss of functional capacity, thus highlighting the fact that most of the patients do not seek treatment until there was disabling limitation of the joint movement and subsequent loss of earning capacity. On subjecting the data of our study to statistical analysis for calculation of odds ratio and logistic regression, the results of our study are in accordance with a similar study carried out by Schneider *et al.*^[7]

Of the 51 patients in our study, split-thickness grafting was done in majority of patients (34 patients – 64.2%) while full-thickness grafts were done in 10 patients and flaps were done in seven patients. The usage of split-thickness skin grafts produces no major donor site morbidity. The operation time compared with the other treatment choices is shorter and the follow-up is easier. The post-operative hospitalization period is shorter. This probably explains the reason why split-thickness grafting was the most preferred treatment of choice. Thus, local flap treatment modality has better outcome with less chances of recurrence and coverage with FTG also has less chances of recurrence but partial graft loss is one of the known complications. In various studies carried out by authors such as Waymach, Cronin *et al.*, and Feldman^[9,10] for the management of contractures for various joints, infection and recurrence remain as the major complication with rates ranging between 5 and 25% of cases. In a study carried out by Mody *et al.*,^[11] the rate of recontracture was 13.6% while Cronin^[9] has described a rate of 17% in his study.

CONCLUSION

The female preponderance can be attributed to the fact that flame burns sustained during cooking due to unsafe modalities of cooking. Most of the patients belonged to the age group of 21–30 years. This age group being involved in the activities like cooking and outdoor work is mostly exposed to hazards of flame burns. Most of the patients were from rural setup, the lack of regular follow-up and subsequent absence of preventive measures can be attributed to the causative factor for contractures. Thermal burns were the most common etiological factor. Flame burns being deeper have more propensities for the development of contractures. Hand deformities formed the major section of our study group which was followed by neck and axilla. Contractures have a disproportionate effect on the upper extremities. Length of stay, total burnt surface area, and lack of physiotherapy and splinting were found to be statistically important predictors for the presence of contractures. Most contractures belonged to Grade 4 of Sheridan and McCauley classification. Only 12% of patients had received physiotherapy and splinting after the initial burns. Rehabilitative strategies and preventive methods have not gained popularity despite widespread prevalence of post-burn contractures. Illiteracy, poor health-care facilities, and lack of compliance on patient's part have compounded the impact. Split-thickness grafting was the most common performed procedure followed by full-thickness grafting, followed by local flaps. Although chances of recurrence are least in full thickness grafting and local flap coverage procedure. Split-thickness grafting was the most common

performed procedure followed by full-thickness grafting, followed by local flaps. Most common complication in our series was wound infection and partial graft loss, followed by partial flap necrosis and recurrence. Only one patient in our study suffered from recurrence in an operated case of post-burn contracture release with split-thickness skin grafting, which was treated with re-grafting.

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