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Incisional release of post burn contracture of upper extremities followed by split thickness skin graft and correlation of outcome with various demographic factors

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KEYWORDS: Post burn contracture, upper extremities, split thickness skin graft, demographic factors

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ABSTRACT

A study of incisional release of post burn contracture of upper extremities followed by split thickness skin graft was carried out and its outcome was correlated with various demographic factors. The most common cause of development of post burn contracture of upper extremity was flame burn (81%), followed by scald burn (9.5%) and electric burn (9.5%). Females (57.1%) were more commonly affected with burn and developed contracture than males (42.9%) due to accidental burn from kerosene or gas chulha (cooking furnace) during cooking. Axillary region was the most frequently involved region with post burn contracture (PBC) followed by elbow region and hand contracture. High incidence of post-burn contracture (PBC) was found in lower socioeconomic group. Low level of education, poverty, unawareness, lack of knowledge about the course of the disease, and lack of post operative physiotherapy and proper splintage lead to development of contracture. Most of the patients developing PBC either did not received post burn physiotherapy or received minimal physiotherapy. Pre and post operative goniometric assessment after three months of contracture release followed by split thickness skin grafting of contracture showed significant improvement in range of motion and satisfactory result was observed in 61.9% of cases.

Introduction

Burn injuries are amongst one of the most devastating of all injuries[1], resulting in an estimated 195000 deaths annually.[2] Unfortunately, the vast majority of burns occur in low- and middle-income countries (LMICs), regions that generally lack the necessary infrastructure to reduce the incidence and severity of burns.[3] They have a great impact on the patients physically, physiologically and psychologically. Dressings with vinegar soaks, tanning solutions, carron oil (mixture of linseed oil and lime water), silver sulfadiazine, and other antimicrobials have been used for treatment purposes and controlling secondary infection. The earliest record of skin grafting goes back to the 5th century AD, where an Indian surgeon, Sushrutha, repaired noses, that were amputated as punishment for crimes, using strips of skin from the forehead which were flapped downwards and grafted over the wound.[4] Sushrutha has also been documented to transplant skin from the buttock to the nose. The first documentation of a modern skin graft in humans was by Carl Bunger in 1823.[4] Contracture from burn injuries were first documented in Eber's Papyrus in 1500 BC, describing the use of copper splints to treat burns.[5,6]

The majority of burns occur in low and middle income countries, with almost half occurring in south-east Asia region accounting for about 27% of global burn deaths.[7] Contraction is a normal process of wound healing. Contraction is the active biologic component of wound healing that decreases the dimension of the involved connective tissue. Contracture is the end result of the process of contraction. In large open wounds left to heal without skin replacement, this phenomenon may be the salvation of patient and surgeon alike. If extremity amputations were all when wound were left open to close by contraction against primary closure which would have led to a high rate of morbidity and mortality from sepsis.[8] Two types of skin grafts are used to cover the burn wound: split thickness skin grafts (STSGs) and full thickness skin grafts (FTSGs). These grafts are frequently required because the release of a post-burn contracture often leaves exposed subcutaneous connective tissue. To become successfully integrated, both types of skin grafts require a vascular wound bed, immobilization of the joint, and the prevention of infection. Common graft complications include wound/graft dehiscence, granulation tissue formation, infection and the need for revisional surgery.[9] Physiotherapy, through active and passive mobilization, is a key component of successful contracture release and should be started soon after the healing is achieved. The main goal of the physiotherapy should be to maintain the length gained by surgery. For contractures of the upper extremity, the secondary goal is to improve the patient's ability to perform actions of daily living.[10] Postburn contractures are perhaps the most dreaded and distressing morbidity in patients surviving major burns. Repair and amelioration of these is essential to make the patient productive and socially acceptable and more importantly to functionally rehabilitate the burn victim.

Demographic factors are personal characteristics are used to collect and evaluate data on people in a given population. Typical factors include age, gender, marital status, race, education, income and occupation. Socio-economic status has been defined as position that an individuals or family occupies with reference to the prevailing average standard of cultural and material possessions, income and participation in group activity of the community.[11] There have been many attempts at developing scales for measuring socio economic status. Hollingshed[12] employed four variables, viz education, occupation, income and housing and proposed four factor index of social status. The variables that affect socioeconomic status are different in case of urban and rural societies. Therefore, separate scales are used for measuring the SES in rural and urban areas.[13] Kuppuswami[14] has prepared a socioeconomic status scale for use in urban areas. This scale is an important tool in hospital and community base research in India. The scale is based on three characteristic s namely education, occupation and income of the family. This scale was originally proposed in 1976. But an income scale usually has relevance only for the period under study. Due to steady inflation and consequent fall in the value of the rupee, the income criteria in the scale loose their relevance. Therefore, this scale like Prasad's scale should also be updated by applying appropriate correction method a per price index of rupee.[15]

Materials and Methods:

A total of 42 patients attending the plastic surgery unit of a tertiary health care referral hospital were studied. After obtaining informed consent, the patient's socio-demographic history, and history of burn injury and contracture were obtained. Kuppuswami socioeconomic status scale (updated for May' 2014)[15] was used to analyse data in this

study. A weighted score is given for each of three characteristics i.e. education, occupation and family income per month and total score is calculated. This weighted score has a range 3 to 29 then based on total socioeconomic score, the individual can be assigned to appropriate socioeconomic class. Scores were given as follows:

Table 1: Scores

Education	
Profession or honors	7
Graduate or postgraduate	6
Intermediate or post-high school diploma	5
High school certificate	4
Middle school certificate	3
Primary school certificate	2
Illiterate	1
Occupation	
Profession	10
Semiprofessional	6
Clerical, shopowner, farmer	5
Skilled worker	4
Semiskilled worker	3
Unskilled worker	2
Unemployed	1
Family income per month (in Rs. as per year 1976)	
› 2000	12
1000-1999	10
750-999	6
500-749	4
300-499	3
101-299	2
100	1
Socioeconomic class	
Upper class	26-29
Upper middle class	16-25
Lower middle class	11-15
Upper lower class	5-10
Lower class	<5

Table 2: Reference index according to year

Year Reference index
1960 100 (base)
1976 296
1982 490-100 (new base, applied by Mishra et al./ for updating in 1998) Price index for 1976 by 1982 base = 100/490 x 296 = 60.408
1998 405
2001 458-100 (new base applied by Kumar et al.,[8] for updating in 2007)
Price index by old base for 2001 = 458
Assuming price index by new base for 2001 = 100
Price index by old base for 1998 was 405
Price index by new base for 1998 = 100/458 x 405 = 88.428
Price index by new base (2001) for 2014 = 244
Conversion factor with 2001 as new base will be 244 + 88.428 = 2.759

Table 3: Updated Kuppuswamy's socioeconomic status scale with updated income range

1971	1997	2008	2006	2014 (May) (Current price index)
≥2000	≥13,408	≥19,844	≥31,507	≥36,997
1000-1999	6704-13,407	9922-19,843	15,754-31,506	18,498-36,996
750-999	5028-6703	7441-9921	11,817-15,753	13,874-18,497
500-749	3352-5027	4961-7440	7,878-11,816	9,249-13,873
300-499	2011-3351	2976-4960	4727-7877	5547-9248
101-299	677-2010	1002-2975	1590-4726	1866-5546
≤100	≤676	≤1001	≤1589	≤1865

Examination of the affected area for type of post-burn contracture, presence of ulcers, hypertrphic scars and/or keloid were done. The active range of movement at each involved joint was measured using a manual goniometer with a standardized technique. The severity of contracture was recorded in degrees. Multiple planes of motions, i.e., flexion, extension, abduction, and adduction were measured at the involved shoulder joints(s) and recorded before surgery. Extension and flexion planes of motion were recorded before surgery for the elbow joint(s). The extension plane of motion was recorded as negative showing the extension deficit of the involved elbow joint.

Contracture release surgery was performed followed by STSG with or without k-wire fixation or z-plasty or flap plasty. After surgery, active range of motion of the operated joint was recorded. Any post-operative complications were recorded. The patients were seen by a physiotherapist and/or occupational therapist for splinting and mobilization exercises. The patients were followed up after discharge at one month and three months interval regarding use of splints, joint mobilization. The range of motion of the affected joints was measured again. The presence of any complication at the operated joint was sought and recorded.

Observations

Out of forty two patients, eighteen were males and 24 were females. The age of the patients ranged from 7 years to 46 years. The occupation of the study subjects is shown in table-4.

Table 4. Occupation of the patients.

Occpation	Frequency	Percentage
Skilled Labour	2	4.8
Unskilled Labour	6	14.3
House wife	12	28.6
Student	18	42.9
Kid	4	9.5

Table 5. Education of study subjects

	Frequency	Percentage
Illeterate	4	9.5
Pre-school	4	9.5
Middle school	8	19
High school	18	42.9
Higher studies	8	19

Table 6. History regarding burn

Characteristics		No.of subjects	Percentage
Degree of burn	2^0 superficial	4	9.5
	2^0 Deep	38	90.5
Mode of burn	Electric burn	4	9.5
	Flame burn	34	81
	Scald burn	4	9.5
Treatment	Govt hospital	42	100
Development of contracture (Month)	‹ 1.5 months	14	33.3
	‹ 1.5 -2 months	20	47.6
	› months	8	19
Physiotherapy received after burn	No	16	38.1
	Yes	26	61.9

Table 7. Pre-operative physiotherapy in study subjects

Pre-operative physiotherapy	Frequency	Percentage
Minimal	32	76.2
Not received	10	23.8

Table 8. Site of burn in study subjects

Site of burn	Frequency	Percentage
Axilla	18	42.9
Axilla & Elbow	4	9.5
Elbow	12	28.6
Hand	8	19

Table 9. Severity of contracture in study subjects

Degree of contracture	Frequency	Percentage

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Mild	4	9.5
Moderate	28	66.7
Severe	10	23.8

Table 10. Deformity in study subjects

Deformity	Frequency	Percentage
Adduction contracture and abduction deformity	20	47.6
Flexion contracture and extension deformity	22	52.4

Table 11. Distribution of patients according to socioeconomic class.

1.	Upper class (26-29)	:	2
2.	Upper middle (16-25)	:	3
3.	Lower middle (11-15)	:	6
4.	Upper lower (5-10)	:	13
5.	Lower (<5)	:	18
	Total	:	42

Discussion

Despite advances in the overall management of burn injuries, severe post-burn contractures continue to be a formidable foe for reconstructive surgeons in developing countries. Not only do we have a higher incidence of burn injuries, we also lack top class facilities for managing acutely burn patients. These factors are further compounded by ignorance, poverty, and adequate utilization of available health care facilities.

Tendency to undergo a cosmetic surgery has been shown to be affected by factors such as gender, age, marital status and education level.[16,17] Further, the tendency to undergo cosmetic surgery is observed to be more prevalent in women population than men.[18] In our study, maximum patients belonged to daily wages group irrespective of the sex. House wives were 28.6% . Most of the our patients (73.8%) belonged to poor upper lower or lower socioeconomic group. This may be because of the almost free surgical treatment provided by our government hospital as compared to private hospitals where the reconstructive surgery charges are very high. Further, rich and affording patients are observed to have preference to go to private hospitals.

Post operative physiotherapy and splinting has important role in preventing re-contracture in post operative period. In this study, out of 42 cases, 16 cases developed re-contracture, it is because of not following proper physiotherapy and splitting protocol. Out of these 16 patients, 12 belonged to upper lower or lower socioeconomic group. Once again, their lower education level, ignorance, non-compliance or not following instructions properly, and early return to work due to their financial condition, were the prime factors.

The surgical procedure undertaken by us had significant outcome after 1 month (p <.0001) and after 3 months (p <.006) as far as joint mobilization and the range of motion of the affected joints was considered. The complications of split thickness skin grafting used for treatment of contractures included graft infection, graft rejection, hematoma formation, etc., were seen in 24% of cases even after adequate care.

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