

ANALYSIS OF UPPER LIMB CONTRACTURES: A 5-YEAR STUDY OF 786 PATIENTS

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ABSTRACT: BACKGROUND: Post burn upper limb contractures is still a common complication, in spite of better treatment available (Debridement, skin substitute and early skin grafting) and early initiation of physiotherapy procedures. In view of broad range of surgical procedures performed at our centre Gandhi Medical College, Plastic Surgery Department Bhopal, we considered it worthwhile to review post-burn contractures of the upper limb, which are amongst the most frequent sequelae we treat. This has been an object of observation also in the past, and we will demonstrate that there has been a consistent increasing trend in the number of patients presenting such burns sequelae, a finding that has a sound explanation.

AIMS: The aim of this study is to demonstrate the continuing high incidence of upper limb contractures in the framework of burns sequelae in our country and to comment on the surgical techniques used to correct these contractures. There are various modalities of approach for contracture release & reconstruction (STG, FTG and Various flaps). Each modality has its own advantages & disadvantages.

METHODS AND MATERIALS: This is a retrospective study of 786 patients of upper limb, post-burn contracture in our hospital between 2011 to 2015.

CONCLUSION: We would point out that this disease can be prevented by better treatment of the burned upper limb, better timing of coverage of the granulated burn wound, and better rehabilitation during convalescence.

KEYWORDS: Upper Limb, Post Burn Contracture, Graft, Splint and Physiotherapy.

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INTRODUCTION: Post burn contracture is a very devastating problem faced by an already overburdened patient. An extensive burn is the most devastating injury a person can sustain and yet hope to survive. Survival is no doubt the immediate concern, it is the restoration to pre-injury status, and return to society becomes important for the victim and the treating team. Burn survival statistics are definitely misleading in this. A healed burn patient may be left with contracture and scars, have varying degrees of functional and aesthetic components.^{[1][2][3]} Their actual incidence is not known. However, it is inversely proportional to the standards of initial treatment with patients receiving best of care having minimum number and severity of these problems.

A burn patient who receives the best of treatment is expected to heal without any contracture.^[4] The incidence of post burn contracture 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 as compared to burns patients. The patients are treated by a variety of service providers who aim in closing the raw wound and this leads to invariably development of wound contraction and scarring.

An understanding of the burn wound healing is fundamental not only to the management of the acute burn wound, but also for the prevention, minimization and treatment of post-burn scars and scar contractures.^{[5][6]} Contraction is an active biological process by which an area of skin loss in an open wound is decreased due to concentric reduction in the size of the wound.

The reduction in size of wound causes lesser degree of connective tissue deposition and the amount of epithelialization needed is decreased. Wound contraction involves an interaction of fibroblasts, myofibroblasts and collagen deposition and is a satisfactory mechanism when the tissue loss is small in a non-critical area and surrounded by loose skin. Scar contracture, on the other hand, is the end result of the process of contraction.^[7]

MATERIAL & METHODS: A Proforma was designed to record the data of patients seeking treatment for upper limb post burn contractures in OPD and Plastic Surgery ward in the Department of Plastic Surgery, Gandhi Medical College and associated Hamidia Hospital Bhopal (MP). The study population consisted of 786 patients from January 2011 to September 2015, who were seen and admitted to our hospital for operation. The parameters analysed were age, sex, time of burn, type of burn, site of contractures and operative procedure.

RESULT: The material consists of the 786 patients we treated for an upper limb contracture in the 5-yr period, 2011-15.

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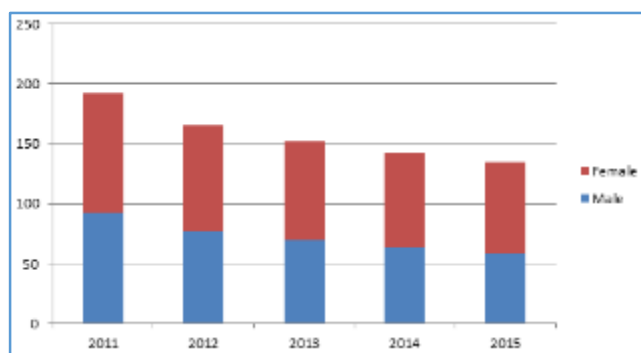
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Year	Male	Female	Total
2011	93	99	192
2012	77	88	165
2013	70	82	152
2014	64	78	142
2015	58	77	135

Table 1: Sex Distribution

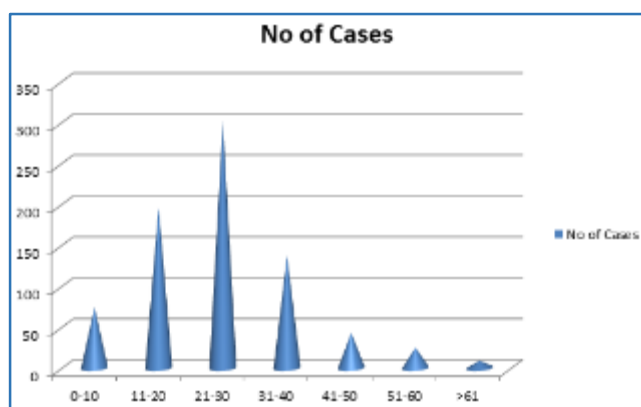
This case report shows more of females preponderance as compared to males, mainly due to more exposure of females to household works/kitchen works and less care of post burn leading to burn contractures.



Age(in years)	No of Cases	Percentage
0-10	74	9.4%
11-20	196	24.9%
21-30	302	38.4%
31-40	137	17.5%
41-50	43	5.5%
51-60	25	3.2%
>61	09	1.1%

Table 2: Age Distribution

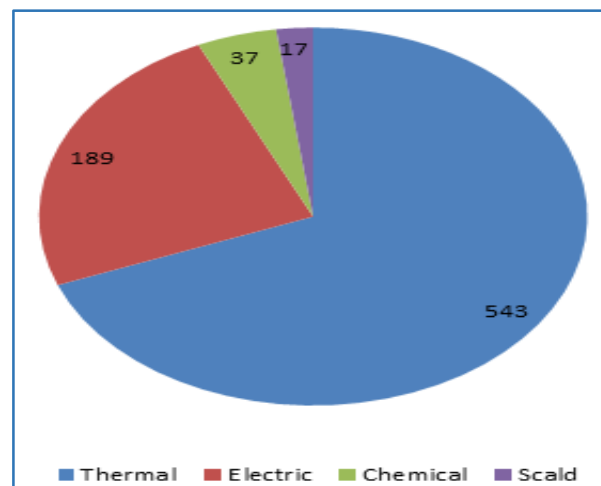
Above table shows peak age distribution between 11-40 years, mainly due to early exposure to thermal burns, as females in our part of the world indulge in household activities early during their routine work.



Type of burn	No of Cases	Percentage
Thermal	543	69%
Electric	189	24%
Chemical	37	4.8%
Scald	17	2.2%

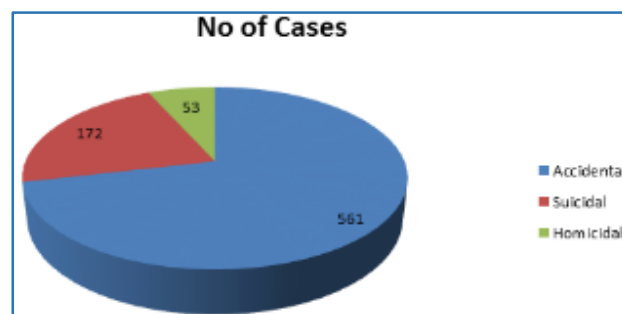
Table 3: Cause of Burn

Above table shows thermal burns as the most common cause of burn mainly due to use of chimney, sighris, stove and kerosene chulhas for kitchen attributes and also that females are more predisposed to burns as shown above.



Type of burn	No of Cases	Percentage
Accidental	561	71.4%
Suicidal	172	21.9%
Homicidal	53	6.7%

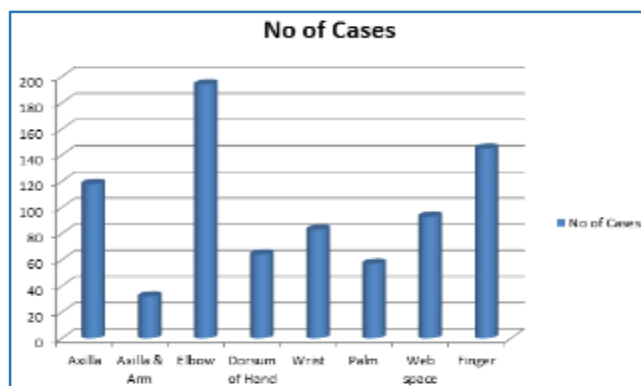
Table 4: Type of Burn



Site of contracture	No of Cases	Percentage
Axilla	118	15%
Axilla & Arm	32	4%
Elbow	194	24.7%
Dorsum of Hand	64	8.1%
Wrist	83	10.6%
Palm	57	7.2%
Web space	93	11.9%
Finger	145	18.5%

Table 5: Site of Contracture

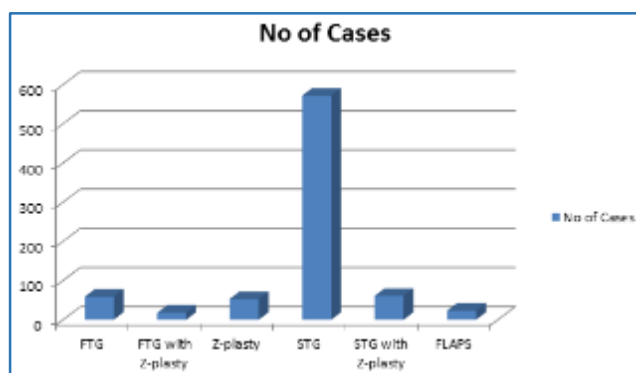
Above table concludes that elbow is the most common site of post burn contracture followed by finger contractures probably may be due to poor wound care and inadequate physiotherapy.



Surgical Technique	No of Cases	Percentage
FTG	59	7.5%
FTG with Z-plasty	18	2.2%
Z-plasty	53	6.8%
STG	572	72.8%
STG with Z-plasty	61	7.8%
FLAPS	23	2.9%

Table 6: Surgical Technique

Above table shows the techniques used for post burn contracture release with effective outcome was split thickness grafting (STG) as a reconstructive surgical technique.



DISCUSSION: Upper limb contracture after deep burns is still a common complication seen in OPD in spite of better treatment now available, early initiation of physiotherapy and the early surgical treatment of deep burns. We operate approximately 156 upper limb contractures per year. The most important and effective method of controlling the wound contraction is to close the wound at the earliest using split skin graft in deep dermal and full thickness burns. Contraction can be inhibited by applying grafts to fresh wounds (As in early excision) or over healthy granulating areas (After eschar separation).

Although full thickness skin grafts inhibits contraction almost completely, but it is not possible in all cases. The split skin graft may also need expansion with meshing in extensive burns. Although this leads to complete healing of wound, with epithelium in interstices of the meshed graft. It is widely believed that thicker the graft, greater will be inhibition of the contraction. This holds true only if the grafts are harvested uniformly. It is the total percentage of dermal thickness grafted, which determines how much contraction will be inhibited. Delayed application of skin graft does not inhibit contraction effectively as immediate grafting.^[8]

The scar collagen and elastin are relatively uncrosslinked and malleable during their initial deposition. Gentle, passive and sustained stretching exploits this malleability and is an effective technique for the lengthening of bands of scar tissue and increasing range of motion in early stages of developing contractures. Surgical intervention after preoperative planning and the necessary lab examination, the operation was performed under general anaesthesia or regional anaesthesia.

Complete release of contracture was done, avoiding damage to any important underlying structure, e.g., arteries, nerves, tendons while excising extra fibrous tissue. As we know contracture occurs in all directions, but the incision begins across the point of maximum tension, i.e., where the contracture is most tight. The incision was zigzag deepening through the contracting scar, saving as much as unscarred healed burned tissues, which is not required to be replaced by skin graft.^[9] The incision is deepened all the way to down till the vascular bed is reached.

All the scarred tissues responsible for the contracture was removed. Full release of the contracture was achieved by means of peripheral incisions and multiple darts at appropriate points along the periphery of the defect respecting anatomical creases across the joints. After the complete release of a post burn contracture, the recreated defect was covered using skin graft or a skin flap.

Most commonly, the raw areas resulting after release of post burn contracture were covered with skin graft. Flap covers were used only when required to cover bare tendons, nerves, vessels, bone or joints only. Elevation of the limb was maintained in postoperative period in order to prevent oedema. We used antibiotics in perioperative period only.

Skin Graft: Split skin graft of intermediate thickness or full thickness skin graft were used. Sheet graft were preferred. The junction line of the sheets of the graft were parallel to the axis of joint motion. Skin graft are immobilised by one or more of the various technique, viz., tie over dressing, plaster of paris splint, crepe bandage, elastoplast, etc., depending upon the site. The grafts were initially assessed on the fourth or fifth day after the operation. Thereafter, dressing changes were carried out every two or three days.^{[10][11][12]}

Skin Flap: There are a few situations where a skin flap is a must. If the contracture release is likely to open up the joint or tendon/nerve as mostly seen in post-electrical burn contractures. Local flap in the form of Z plasty, VY plasty and transposition flaps were used. Flaps decrease the need for postoperative splintage to prevent secondary graft contraction.^{[13][14]} Maintenance of released/corrected position is mandatory until the graft has become stable or till the flap margins have healed.

Postoperative use of static or dynamic splints, interspersed with a routine of daily physical therapeutic exercise is required to keep the joints in full range of motion. This therapy is continued till the graft is matured and complete range of motion is achieved. All grafts were lubricated with coconut oil in postoperative period to prevent cracks due to stretching while doing mobilization across the joint during physiotherapy.

CONCLUSION: There is increasing tendency of hypertrophic scarring and contracture seen in second degree deep burns when it has taken more than 3 weeks to heal. It has been noticed that early coverage of wound decreases contracture formation. Splinting from day 1 of burns is very important for prevention of contractures and it also improves results in post-operative cases. Application of split thickness skin graft after release of contracture even with strict splinting & meticulous follow-up has still yielded recurrences. Post-operative splinting and physiotherapy can reduce the recurrence and improved compliance of patient can finally make results better with functional rehabilitation as well.

With this study we can conclude that:

1. Post burn contractures being more common in uneducated society with limited patient follow-up and poor health awareness. These contractures can be prevented during in-patient care of burn victims.
2. Upper limb contractures are better prevented than treated. This means careful treatment of the burned limb, especially in deep second- or third-degree burns. Early surgical treatment of deep wounds, immobilization, and application of early escharectomy with immediate skin grafting should be preferred and is advocated.
3. If already established, a post-burn limb contracture must be treated as soon as possible. This will yield better results. Early treatment of established contractures prevents tissue fibrosis, tendon shortening, and joint stiffness.
4. Careful planning and timing of the different stages of treating a contracted burned limb are very important for better final results.
5. At the time of discharge proper education of post-operative care & adequate information of oil massage, physiotherapy and pressure garment should be given to the patient and their relatives.

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