

A Prospective Study of Axillary Post-Burn Contractures at a Leading Tertiary Care Facility

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ABSTRACT

Background: Burn injuries can result in various complications, including post-burn contractures that severely impact physical and psychological well-being, especially when they occur in critical areas like the axilla. The axilla's crucial role in upper limb functionality and its susceptibility to complications make it a significant concern. This study conducted in a tertiary care facility aims to comprehensively examine the prevalence, causative factors, and management of axillary post-burn contractures, contributing to the field of burn care and reconstructive surgery.

Methods: A prospective study was conducted with 30 patients presenting with axillary post-burn contractures. Inclusion criteria included patients willing to undergo surgery for the condition, while exclusion criteria eliminated those with contractures developing within six months of burn injuries. Data on patient characteristics, burn etiology, contracture type, and preoperative assessments were collected. Various surgical techniques were employed based on individual evaluation.

Results: The study included patients with a mean age of 22.1 years, primarily in the 11-30 age groups, with 60% of burns caused by flame burns. Most patients presented several months to years after burns, with none receiving physiotherapy or splinting during the acute burn stage. Preoperative abduction ranged from 20° to 90°, improving significantly postoperatively, with a mean of 129.7°. Surgical techniques varied based on contracture type, and complications were manageable.

Conclusion: This study sheds light on the prevalence and management of axillary post-burn contractures, emphasizing the need for early intervention and specialized care. It underscores the importance of public awareness and prevention strategies for burn injuries, particularly flame burns. The study's findings align with existing literature and provide insights into this challenging condition.

Recommendation: Recommendations include enhancing burn prevention and education programs, promoting early intervention, adopting a multidisciplinary approach to care, and encouraging further research and innovation in surgical techniques and postoperative care.

Keywords: Axillary Post-Burn Contractures, Flame Burns, Surgical Interventions, Rehabilitation.

INTRODUCTION

Burn injuries, resulting from various causes such as thermal, chemical, or electrical incidents, can give rise to a wide array of complications, some of which can significantly impact the affected individual's physical and psychological well-being [1]. Among these complications, post-burn contractures stand out as a particularly pressing concern, especially when they manifest in functionally critical areas of the body [2]. One such anatomical region where the development of post-burn contractures can have profound consequences is the axilla, commonly known as the armpit.

The axilla plays a crucial role in the functionality of the upper limb, serving as a junction for the arm's movements and housing a complex network of nerves, blood vessels, and lymphatic structures. When post-burn contractures occur in this region, they can severely restrict the range of motion of the arm and compromise the overall mobility of the affected individual [3]. Moreover, the axilla's proximity to vital structures makes it particularly susceptible to complications such as neuropathies, vascular compromise, and lymphedema, further exacerbating the challenges faced by patients.

To address the multifaceted issues associated with axillary post-burn contractures, this clinical investigation is focused on a leading tertiary care facility. Tertiary care centers are renowned for their capacity to deliver highly specialized and advanced medical services. They possess the expertise, resources, and state-of-the-art treatment modalities necessary to manage complex medical cases effectively. In the context of this study, the primary objective is to comprehensively examine the prevalence, causative factors, and management strategies pertaining to post-burn contractures of the axilla within this specialized healthcare environment.

The significance of this investigation lies in its potential to enhance our understanding of the unique challenges posed by axillary post-burn contractures and the intricacies involved in their management. By conducting this study within a prominent tertiary care facility, we aim to gain insights into the prevalence rates of this condition, the diverse factors contributing to its development, and the various therapeutic approaches employed to address it. Such insights are invaluable not only in informing clinical practice but also in guiding future research and advancements in the field of burn care and reconstructive surgery.

The primary objective is to assess the outcomes of various surgical procedures used to address post-burn contractures of the axilla, including their effectiveness in restoring functionality and minimizing associated complications. The study will also investigate potential complications that may arise from these surgical interventions, providing crucial information for healthcare professionals to make informed decisions regarding patient care and treatment strategies.

METHODOLOGY

Study Design:

A prospective study was conducted.

Study setting:

The research took place at E.S.I.C. Andheri, Mumbai, over a period spanning from '2021 to 2023'.

Participants:

A total of 30 patients who presented with post-burn contractures (PBC) in the axillary region.

Inclusion Criteria:

The study addressed all patients who presented with post-burn contractures in the axilla and were willing to have surgery to treat the condition.

Exclusion Criteria:

The study eliminated patients who developed axillary contractures fewer than six months after suffering burn injuries.

Bias:

To minimize selection bias, all eligible patients meeting the inclusion criteria were considered for participation. The objective and details of the study were explained to all prospective participants, and informed consent was obtained.

Variables:

Surgical outcomes and procedure-related complications are the dependent variables in this study. The independent variables include patient age, condition onset, burn aetiology, management of the initial acute phase, type and degree of contracture, scar maturation, and surrounding skin condition. To determine how these characteristics affect surgical outcomes and complications, an analysis of them will be conducted.

Preoperative Assessment:

The preoperative evaluation took a holistic approach. To establish the scene for the investigation, the age of the patient and the exact moment the contracture began were carefully recorded. A thorough medical history was gathered, with special attention paid to determining the causes of the burn and the early care given during the injury's acute phase. A general examination was performed in order to obtain a comprehensive grasp of the patient's condition. Moreover, the purpose of preoperative physical therapy was to target stiffness in the shoulder joint and

maximize the chance of maximal contracture release. The study's crucial baseline parameter, the preoperative shoulder joint abduction degrees, could be precisely measured with a goniometer, which was used in conjunction with this intervention.

Surgical Procedures:

After applying the Kurtzman and Stern classification system, patients were divided into three types: Type 1 contractures affected either the anterior (1A) or posterior (1B) axillary fold, Type 2 contractures affected both the anterior and posterior axillary folds, and Type 3 contractures affected both the axillary folds and the axillary dome. The choice of surgical technique was dependent on careful evaluation, which included the extent and site of the contracture, the state of the surrounding skin, and the features of the scar. Each patient received a customized surgical technique that was best suited to their individual clinical presentation and needs thanks to this careful assessment.

Preoperative Marking:

Precise measures were conducted in the preoperative period to guarantee accuracy and patient agreement. First, in order to precisely delineate the contracture location, markings were carefully applied while the patient was standing with their hand maximally abducted. Preoperative photos were also taken to help with surgical planning and to document the condition.

Procedures:

Excision or contracture release was performed during the surgical operations, paying close attention to every little detail. To maximize functional results, the axilla's angle was painstakingly modified to come as near as feasible to the 180–150 degree range. Fish-tail cuts were expertly used to help with the release. During the surgical procedure, extra precautions were taken to guarantee efficient hemostasis and reduce the danger of bleeding. In order to tailor the surgical intervention to the specific requirements and circumstances of each patient, a thorough evaluation of various factors was conducted, including the type of scar, the degree of surrounding skin scarring, and the size and exact location of the defect.

Postoperative Care:

Postoperative care protocols were carefully followed, which included the use of an aeroplane splint to preserve complete axillary abduction. As a preventative step, a course of broad-spectrum antibiotics was given for five days. While graft cases received their primary dressing on the fifth day following surgery, flap cases underwent dressing changes based on the level of soakage. The use of splints was continued throughout the healing process. In order to monitor recovery and handle any issues, an organized follow-up schedule was devised, with monitoring visits planned for two weeks, one month, three months, and six months after surgery. Approximately two weeks following surgery, patients began four daily sessions of physiotherapy. To maximize recovery results, the splint was worn day and night for the first three months before switching to nightly splint application and daytime physical therapy.

Statistical Analysis:

The study will employ statistical analysis to assess the surgery outcomes, complications, and other pertinent data gathered. When applicable, descriptive statistics like means, standard deviations, and frequencies were included. If inferential statistics are thought to be required for particular analysis, they were used.

Ethical Considerations:

Informed consent was obtained from all study participants after providing a clear explanation of the study's objectives and potential risks. The study protocol received approval from the relevant ethical review board or committee.

RESULT

Table 1: Clinical parameters of participants

Parameter	Number of Patients
Total Number of Patients	30

Age Range (years)	6 - 50
Mean Age (years)	22.1
Age Group (11-20 years)	10
Age Group (21-30 years)	12
Gender (Male)	18
Gender (Female)	12
Right Axilla Involvement (%)	43.3%
Left Axilla Involvement (%)	33.3%
Bilateral Axilla Involvement (%)	23.3%
Primary Cause of Burns (Flame Burns)	60%
Primary Cause of Burns (Scalds)	33.3%
Primary Cause of Burns (Electrical Burns)	6.7%
Time Since Burn Presentation	
- 6 to 12 months	12
- 13 to 24 months	10
- Over 3 years	8
Received Physiotherapy/Splinting	None

The study included 30 patients with ages ranging from 6 to 50 years and a mean age of 22.1 years. Among these patients, 10 were in the 11 to 20 age group, and 12 were in the 21 to 30 age group. Out of the total participants, 18 were male, and 12 were female. In terms of the affected

axilla, 13 patients (43.3%) had right-sided involvement, 10 patients (33.3%) had left-sided involvement, and both axillae were affected in 7 patients (23.3%). The burns were primarily caused by flame burns in 18 patients, scalds in 10 patients, and electrical burns in two patients. Additionally, 12 patients presented 6 to 12 months after sustaining burns, 10 patients presented between 13 to 24 months, and 8 patients presented after 3 years. Notably, none of the patients reported receiving physiotherapy or splinting during the acute burn stage treatment.

Table 2: Surgical outcomes

Surgical Outcome	Measurement
Pre-operative Abduction Range	20° - 90°
Mean Pre-operative Abduction	49.3°
Post-operative Abduction Range	90° - 160°
Mean Post-operative Abduction	129.7°

Axillary post-burn contractures were identified as a common issue, particularly among individuals with lower socio-economic backgrounds, often leading to significant physical and social limitations. The right axilla was involved in 43.3% of patients, the left axilla in 33.3%, and both axillae were affected in 23.3% of cases. Flame burns were the leading cause of burns in the study (60%), followed by scalds (33.3%) and electrical burns (6.7%). Most patients in the study presented several months to years after sustaining burns, and none had received physiotherapy or splinting during the acute burn stage treatment. Pre-operative abduction ranged from 20° to 90°, with a mean of 49.3°. Post-operative abduction improved significantly, ranging from 90° to 160°, with a mean of 129.7°. Various surgical techniques were employed for contracture release and reconstruction, including skin grafts, Z-plasties, local flaps, and more, depending on the type of contracture. Complications were observed in some cases, including tip necrosis, graft or flap loss, and recontracture, although most were manageable with appropriate interventions.

DISCUSSION

In the present study, 30 patients with axillary contractures were examined, with ages ranging from 6 to 50 years and a mean age of 21.85 years. The study cohort included 12 male and 8 female patients. Among them, 45% had right-sided axillary involvement, 35% had left-sided involvement, and 20% had bilateral axillary contractures. Flame burns were the leading cause of burns in this group, accounting for 60% of cases, followed by scalds at 35%, and electrical burns at 5%. Most patients in the study sought medical attention several months to years after sustaining burns, with an average duration since burns of 25.75 months. Notably, none of the patients had received physiotherapy or splinting during the acute burn stage treatment.

In comparison to other studies, [4] included 37 patients with axillary contractures, aged between 2 and 47 years, with a mean age of 23.1 years. [5] studied 16 patients, with a mean age of 25.2 years. In [6] research, 42 patients with axillary contractures had a mean age of 14.7 years, while [7] reported a mean age of 17.1 years among their patients. [8] study involved patients with an age range of 3 to 62 years, with a mean age of 26.2 years. [9] reported a mean age of 21 years among their subjects, and Durga Karki et al. found a similar mean age of 17.1 years in their study group.

In the present study, 45% of patients had right axillary involvement, 35% had left axillary involvement, and 20% had bilateral axillary contractures. Similarly, [4] reported right axillary involvement in 51.4% of patients, left axillary involvement in 37.8%, and bilateral involvement in 10.8%. [7] observed a nearly equal ratio of right and left axillary involvement at 1:1.8. Contracture types also varied, with some patients having involvement of the anterior axillary fold, posterior axillary fold, or both, along with the axillary dome.

The primary causes of burns in the present study were flame burns in 60% of cases, scalds in 35%, and electrical burns in 5%. This distribution aligns with the findings of [5], who reported flame burns in 75% of cases and scalds in 25%. [4] found that flame burns accounted for 48% of injuries, while corrosive agents were responsible for 32%, and scalds for 20%. In [6] study, flame burns were seen in 66.7% of cases, and scalds in 33.3%. In the study by [9] noted that 64% of burns were due to flames, 27% to hot fluids, and 4.5% to chemical fluids.

The duration since the burns in the present study ranged from 1 to 30 years, with a mean of 25.75 months. This aligns with the findings in other studies, where the time since the initial burn varied. [6] reported a mean time from the initial burn to release of 3 years, with a range of 1 to 8 years. [10] found that the duration since burns ranged between one to 5.5 years, with a mean of 28 months. [8] reported a mean duration of 3.7 years for post-burn scar contractures of the axilla, with a range from 1 to 30 years. [9] observed a mean duration of 3.3 years, ranging from 1 month to 20 years.

Interestingly, none of the patients in the present study reported receiving physiotherapy or splinting during the acute burn stage treatment. This was consistent with the observations in the studies conducted by [5] and [11], where patients either had no history or minimal history of splinting during acute burn stage treatment.

In terms of the surgical approach to contracture release and reconstruction, the present study utilized various techniques, including split-thickness skin grafts, multiple Z-plasties, local flaps, parascapular flaps, thoracodorsal artery perforator flaps, and propeller flaps, depending on the type of contracture. [5] primarily used split-thickness skin grafting, Z-plasty, and flaps. [6] employed Z-plasties and flaps in their patients, while [11] used split-thickness skin grafts, Z-plasties, flaps, and square flaps. [12] reported using skin grafts, Z-plasty, five flaps, and regional flaps. [4] favored local fasciocutaneous flaps, single and multiple Z-plasties, skin grafts, and myocutaneous flaps for reconstruction. In [9] study, local reconstruction with various plasties and skin grafts was the predominant approach, while [11] utilized a combination of skin grafts, local skin flaps, Z-plasties, parascapular flaps, propeller flaps, and square flaps.

Regarding complications, the present study observed graft loss, recurrence, and tip necrosis in some patients following contracture release and skin grafting. These complications were in line with findings from other studies. [4] reported graft shifts, recontractures, tip necrosis, and epidermolysis as common issues in their patients, which often healed with minimal intervention. [7] noted skin graft loss and partial local flap necrosis in their patients, with some requiring secondary procedures for wound closure. [10] also found complications in the form of tip necrosis and partial graft loss in a subset of their cases.

CONCLUSION

The present study investigated axillary post-burn contractures in 30 patients, examining various factors such as age, gender distribution, contracture types, causes of burns, duration since burns, and surgical techniques used for reconstruction. The study's findings were comparable to those reported in similar studies, shedding light on the prevalence and management of this challenging condition.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: Recommendations include enhancing burn prevention and education programs, promoting early intervention, adopting a multidisciplinary approach to care, and encouraging further research and innovation in surgical techniques and postoperative care.

Acknowledgement: We are thankful to the patients; without them the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in patient care of the study group.

List of abbreviations:

PBC - Post-Burn Contractures

Source of funding: No funding received.

Conflict of interest: The authors have no competing interests to declare.

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