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Management of Post-burn Sequelae- A Prospective Observational Study

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Abstract **Original Research Article**

Background: Burn injuries are a major global health issue, causing significant morbidity and mortality, especially in low- and middle-income countries. They often lead to complications such as contractures, scarring, pigmentation and changes, affecting the patient's quality of life. The healing process can result in fibrotic tissue deposition, causing functional and cosmetic impairments. Hypertrophic scars and contractures are common sequelae due to excessive collagen deposition. Management involves surgical approaches, such as skin grafting and flap surgery, and non-surgical methods, such as pressure garments and laser therapy, to improve outcomes and prevent complications. ***Aim of the study:*** This study aims to evaluate the effectiveness of surgical interventions in managing post-burn sequelae, focusing on functional and aesthetic outcomes. ***Methods:*** This prospective observational study was conducted in the Burn and Plastic Surgery Department, Dhaka National Medical College and Hospital, Dhaka, Bangladesh over 12 months from January to December 2018, involving 95 burn cases. Ethical approval was obtained, and informed consent was secured from all participants. Inclusion criteria comprised patients aged ≥10 years with post-burn sequelae, while exclusion criteria involved those with acute burns or severe comorbid conditions. Data were collected using structured sheets, patient interviews, medical records, and physical assessments. Surgical approaches, including skin grafting and contracture release, were evaluated for efficacy based on mobility, scar reduction, and complications using SPSS for data analysis. ***Result:*** The study identified common post-burn complications, including scar contractures (68.42%), hypertrophic scars (10.53%), and pigmentation changes (9.47%). Surgical interventions such as skin grafting (31.58%) and flap surgery (15.79%) were frequently performed to address severe scarring and contractures. Treatment outcomes were generally positive, with 63.16% achieving functional improvement and 57.89% showing scar improvement. However, 21.05% had no significant change, and 5.26% worsened. Complications such as pain (12.63%), recurrence of contractures (10.53%), and infections (8.42%) were also observed, emphasizing the need for individualized, long-term care and rehabilitation. ***Conclusion:*** This study emphasizes the importance of surgical interventions in post-burn care, particularly for scar contractures. While 63.16% of patients showed functional improvement, challenges like pain, recurrence, and infections highlight the need for personalized, ongoing care and long-term monitoring to optimize recovery and prevent further complications.

Keywords: Post-burn sequelae, Burn complications, Scar contracture, Hypertrophic scars and Treatment outcomes.

INTRODUCTION

Burn injuries remain a significant global health concern, contributing to substantial morbidity and mortality. According to the World Health Organization (WHO), approximately 11 million burn injuries require medical attention annually, with the majority occurring in low- and middle-income countries [1]. Burn injuries can lead to severe post-burn sequelae, including contractures, keloid and hypertrophic scarring, pigmentation changes, and psychological distress, all of which can significantly affect a patient's quality of life [2]. Managing these complications requires a multidisciplinary approach, incorporating surgical and non-surgical interventions tailored to individual patient needs. The healing process following a burn injury is

complex and involves inflammation, proliferation, and remodeling phases. When the dermis and epidermis are extensively damaged, the repair process often results in fibrotic tissue deposition, leading to functional and cosmetic impairments [3]. Hypertrophic scars and contractures are the most common sequelae, occurring due to excessive collagen deposition and myofibroblast activity, which cause skin tightness and joint immobility [4]. Psychological and social factors also play a crucial role, as patients with extensive burns often suffer from post-traumatic stress disorder (PTSD), depression, and anxiety [5]. The management of post-burn sequelae is categorized into surgical and non-surgical interventions. Surgical management includes skin grafting, flap surgery, and contracture release procedures. Skin grafting is widely used for extensive burns to improve mobility and aesthetics [6]. Flap surgery, including local, regional, and free flaps, provides coverage for severe contractures and exposed vital structures [7]. Surgical excision of hypertrophic scars followed by grafting or tissue expansion techniques can also enhance functional outcomes [8]. Non-surgical interventions include pressure garments, silicone gel sheets, laser therapy, and physiotherapy. Pressure therapy is the gold standard for hypertrophic scar prevention, exerting mechanical force to realign collagen fibers and reduce scar height [9]. In recent times, burn injuries have emerged as a significant global health concern, contributing to substantial morbidity and long-term physical and psychological challenges. The complex nature of post-burn sequelae, including hypertrophic scarring, contractures, and impaired mobility, necessitates a multidisciplinary and patient-centred approach to optimize recovery. This study aims to evaluate the effectiveness of surgical interventions in managing post-burn sequelae, focusing on functional and aesthetic outcomes.

METHODOLOGY & MATERIALS

The prospective observational study was conducted in the Burn and Plastic Surgery Department, National Medical College and Hospital, Dhaka, Bangladesh. The hospital provides specialized burn care services, including acute burn management, reconstructive surgery, and rehabilitative therapies. A total of 95 burn cases were observed in this study during 12 months from January to December 2018. Ethical approval was obtained from the hospital's Institutional Review Board (IRB). Written informed consent was obtained from all participants, and patient confidentiality was maintained throughout the study.

Inclusion Criteria:

- Patients aged ≥10 years with documented post-burn sequelae.
- Patients who had sustained burns at least six months prior to enrollment.
- Patients undergoing surgical management for post-burn complications.

Exclusion Criteria:

- Patients with acute burn injuries requiring emergency care.
- Patients with severe comorbid conditions that could confound study outcomes.
- Patients unwilling or unable to provide informed consent.

A comprehensive and structured data collection sheet was utilized to systematically record demographic details, burn characteristics, types of sequelae, and management approaches. Data were obtained through multiple sources to ensure accuracy and completeness. Patient interviews and detailed medical history reviews provided insights into individual cases, while thorough physical examinations and clinical assessments captured the extent and nature of post-burn sequelae. Medical records, surgical notes, and therapy progress reports were meticulously reviewed to document treatment interventions and patient responses.

Management Approaches:

The study incorporated both conventional and advanced surgical management techniques to effectively address scar contractures and keloids. Surgical interventions included skin grafting, where autologous or allogeneic grafts were utilized to restore skin integrity; contracture release procedures, aimed at improving joint mobility and preventing deformities; and flap surgeries, such as local, regional, or free flaps, to enhance tissue coverage, vascularization, and aesthetic outcomes. The surgical techniques were selected based on the severity of contractures, patient-specific factors, and the desired functional and cosmetic improvements.

Outcome Measures:

The effectiveness of these management strategies was systematically evaluated through qualitative and quantitative parameters. Key outcome measures included functional mobility improvement, assessed using range-of-motion tests and patient-reported functional scores; reduction in scar contractures and keloids, measured via clinical assessments, imaging techniques, and validated scar severity scales; and the incidence of treatment-related complications, such as infection, graft failure, hypertrophic scarring, and donor-site morbidity. These parameters comprehensively assessed surgical efficacy, patient recovery, and long-term therapeutic success.

Data Analysis:

Data were analyzed using SPSS software (Version 26.0). Descriptive statistics were used to summarize patient demographics and treatment modalities. Comparative analysis was performed to assess differences in outcomes between surgical and non-surgical groups.

RESULT

Table 1 highlights the different post-burn sequelae observed in the study population. The most common complication was scar contracture (68.42%), which aligns with the fact that deep burns often lead to tissue fibrosis and contractures, limiting movement. Hypertrophic scars (10.53%) and pigmentation changes (9.47%) were also notable sequelae commonly associated with burn wound healing. Keloid formation (5.26%) and syndactyly (4.21%) were less frequent but required intervention. Skin grafting (31.58%) was the most frequently performed surgical intervention, underscoring its role in resurfacing contractures and deep scars. Flap surgery (15.79%) was used in cases where simple grafting was insufficient, typically for extensive contractures or exposed vital structures. Contracture release procedures (10.53%) were also common, particularly for patients with severe joint restrictions. A smaller percentage (5.26%) underwent other surgical procedures, indicating individualized approaches based on patient needs (Table 2). Table 3 indicates positive treatment outcomes in most cases. Functional improvement (63.16%) was the most notable achievement, demonstrating that post-burn interventions effectively restore mobility. Scar improvement (57.89%) addressed physical well-being. However, 21.05% of patients showed no significant change, and 5.26% had worsened conditions, highlighting the challenges in burn sequelae management. Despite effective treatment, complications were observed in some patients. Pain (12.63%) was the most reported issue, likely due to nerve involvement or inadequate healing. Recurrence (10.53%) of contractures or scarring suggests that long-term monitoring and rehabilitation are essential. Infections (8.42%) were another concern, emphasizing the need for stringent postoperative care. Other complications (5.26%), including delayed wound healing or graft rejection, further underline the importance of individualized post-treatment care (Table 4).

Table 1: Distribution of Post-Burn Sequelae among Patients

Sequelae Type	Frequency (n)	Percentage (%)
Scar Contracture	65	68.42
Hypertrophic Scar	10	10.53
Pigmentation Changes	9	9.47
Keloid Formation	5	5.26
Syndactyly	4	4.21

Table 2: Types of Surgical Interventions for Post-Burn Sequelae

Surgical Treatment Type	Frequency (n)	Percentage (%)
Skin Grafting	30	31.58
Flap Surgery	15	15.79
Contracture Release	10	10.53
Other	5	5.26

Table 3: Treatment Outcomes in Patients with Post-Burn Sequelae

Outcome Type	Frequency (n)	Percentage (%)
Improvement in Functionality	60	63.16
Scar Improvement	55	57.89
No Change	20	21.05
Worsened Condition	5	5.26

Table 4: Post-Treatment Complications among Patients

Complication Type	Frequency (n)	Percentage (%)
Recurrence	10	10.53
Infection	8	8.42
Pain	12	12.63
Other	5	5.26

DISCUSSION

The findings of this study provide a comprehensive overview of the management of post-burn sequelae, emphasizing the necessity of surgical interventions to achieve optimal patient outcomes. The prevalence of scar contractures (68.42%) as the most common sequela aligns with existing literature, underscoring contractures as a primary complication following deep burns [13]. The high incidence of contractures can be attributed to extensive collagen deposition and fibrosis, which limit mobility and necessitate surgical release procedures [14]. Hypertrophic scars (10.53%) and pigmentation changes (9.47%) were also prevalent, reinforcing the importance of post-burn scar modulation techniques such as pressure therapy and laser treatments [15]. Less frequent complications like keloid formation (5.26%) and

syndactyly (4.21%) highlight the variability in burn wound healing responses, often requiring individualized treatment plans [16]. Management strategies observed in the study confirm the pivotal role of surgical intervention in severe cases, with 57.89% of patients undergoing operative procedures. Skin grafting (31.58%) was the most commonly performed surgical technique, consistent with its established role in resurfacing areas of extensive tissue loss and contractures [17]. Flap surgery (15.79%) was employed in cases where grafting alone was insufficient, particularly for patients with exposed tendons, bones, or vital structures, as noted in prior studies [18]. Contracture release procedures (10.53%) were necessary for patients with significant functional limitations, reaffirming the need for early intervention to prevent long-term disability [19]. These findings underscore the importance of reconstructive surgery in post-burn care, with individualized approaches tailored to the severity and location of deformities. Treatment outcomes were generally favourable, with functional improvement (63.16%) being the most reported benefit. Restoring mobility and reducing contractures align with previous research advocating for early surgical intervention and rehabilitation to optimize patient recovery [20]. Additionally, significant scars (57.89%) highlight post-burn treatment's holistic impact, addressing both physical and emotional sequelae [21]. Nonetheless, the persistence of unchanged (21.05%) or worsened conditions (5.26%) underscores the challenges in achieving uniform success, indicating the need for long-term follow-up and individualized care [22]. Despite these advancements, complications such as pain (12.63%), recurrence (10.53%), and infections (8.42%) were noted, reaffirming the necessity of meticulous postoperative care and rehabilitation [23].

Limitations of the study: The study's limitations include its retrospective design, which may introduce selection bias. The lack of long-term follow-up data also hinders the assessment of long-term outcomes and recurrence rates. Variability in individual responses to treatment also complicates the analysis of outcomes.

CONCLUSION

In conclusion, this study highlights the significant role of surgical interventions in managing post-burn sequelae, with scar contractures being the most prevalent complication. Skin grafting and flap surgeries were essential in addressing tissue loss and extensive contractures, leading to favorable functional outcomes. While 63.16% of patients showed functional improvement, challenges remain, as evidenced by the persistence of unchanged or worsened conditions in some cases. Complications such as pain, recurrence, and infections underscore the need for ongoing, individualized care and long-term monitoring to optimize recovery and prevent further complications. These findings emphasize the importance of tailored post-burn rehabilitation and follow-up.

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