

# Burn Contracture in Children: Case Series and Literature Review

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**Abstract:- Introduction:** Contracture after a burn injury is the most common complication that might happen. The child's healing process is faster than that of adults, causing a faster development of contracture unless the joint is directly injured. In developing country such as Indonesia, it is harder for children with burn injuries receive acute burn care, resulting a debilitation joint and soft tissue contracture. **Case Series:** We presents six case series of burn contracture in children with various clinical appearance and predilection. The challanges of burn injury in children especially in this case series is the knowledge of parent in urban area such as nutritional status, believing in traditional methods, timing to ask for help, and the parental concern. Many challenges we found when we discussion with parents. **Discussion:** Along with the technology and knowledge development, there is various way to overcome contractures. Some of them such as, doing incisions in parallel to relaxed skin tension lines also can minimize the chance of contracture. In other hand, if contracture already happen, reconstructure procedure should be done. Apart from the impact of the injury and its treatment, parents' reaction and responses to the traumatic event have been shown significantly to influence the child's functioning, wellbeing and phycological recovery. **Conclusion:** Preventive procedure in contracture may leading to decrease huge costs of care and significant physical, psychological, and economic reactions on the burned survivor and their families. Without having to face effects of these contractures, excellent education and regular patient monitoring can provide positive results.

**Keywords:-** Burn; Contracture; Children; Flaps; Reconstruction.

## I. INTRODUCTION

Burn contractures in children pose a significant challenge in the field of medicine, necessitating a multidisciplinary approach for effective management. These contractures, resulting from burns that restrict extremity movements, have been a focal point of research aimed at understanding prevention and treatment (1). While historically, burn care has primarily focused on physical healing, recent studies have highlighted the psychological impact of pediatric burn injuries, emphasizing the necessity of

a holistic treatment approach addressing both physical and psychological aspects (2). Non-compliance with antideformity splints and physiotherapy has been identified as a factor contributing to post-burn contracture development, underscoring the significance of early surgical management, physiotherapy, and appropriate splinting to mitigate contracture formation (3).

In instances where burn injuries lead to contractures, reconstructive procedures such as utilizing free tissue flaps have been employed to restore function and mobility in affected areas (1). Additionally, skin grafting has been utilized in pediatric patients with contact burn injuries to manage issues like cicatrix and contracture formation, showcasing the array of surgical interventions available for addressing burn-related complications in children (4). Moreover, the use of dehydrated human amnion chorion membrane has shown promise in pediatric burn treatment, highlighting the importance of innovative approaches to enhance outcomes and prevent long-term functional loss and disfigurement in young patients (5).

Research has also delved into the role of skin substitutes in acute burn and reconstructive surgery, emphasizing the impact of burns on psychosocial well-being and stressing the need for comprehensive care addressing both physical and emotional aspects of recovery (6). Furthermore, studies on the use of non-medicated dressings for superficial-partial thickness burns in children have provided insights into age-specific treatment modalities, considering factors such as the frequency of scald injuries in the pediatric population (7). These findings underscore the importance of tailored approaches to burn care that consider the unique needs of children to achieve optimal outcomes.

In cases where burn injuries result in post-traumatic contractures, particularly in areas like the elbow, surgical interventions have been explored to tackle the challenges associated with managing contractures in children and adolescents. Similarly, the use of surgical release procedures for posttraumatic elbow contractures highlights the complexity of managing such conditions and the necessity for specialized interventions to restore range of motion and function in affected joints (8). Additionally, reconstructing burn contractures with techniques like the free anterolateral thigh flap showcases advancements in surgical approaches aimed at enhancing outcomes and quality of life for pediatric patients with burn-related contractures (1).

Burns are a major cause of morbidity and mortality in children (9). According to the WHO, 1 million burn injuries of all types occur each year, resulting in 180,000 fatalities (10). According to the data from the Ministry of Health in Indonesia at 2018, 0.7% of burns occur in Indonesia (11).

Burn injuries are the fifth leading cause of nonfatal childhood injuries (10). The non-fatal burns are a major contributor to morbidity, which includes long hospitalizations, disabilities, and difficulties returning to normal life. Burn contractures are one type of burn morbidity. Burn contracture will affect the patient's quality of life, if not treated immediately (12). Children with burns, in particular, should be followed up regularly to identify the problematic scar early. As we know that children healing process is faster than adult, causing a faster development of contracture unless the joint is directly injured. There are numerous cases of burns in children, but in developing countries such as Indonesia, children with burn injury is harder to receive an acute burn care.

There are challenges that prevent patients from receiving immediate burn treatment, resulting in joint and soft tissue contracture (13,14). At hospital discharge, approximately one-quarter of children with a major burn injury developed a contracture, so this could potentially increase as the child grows (15).

Over the years, the management of contracture wounds has frequently been practiced, with local flap techniques, triangular - flap techniques - Z and Y on plastic modifications, and a combination of the two being the main treatment for contractures (16). Therefore we will discuss about some types of therapy and surgical management that can be done on patients with contractures.

**II. LITERATURE REVIEW**

Burn contractures in children pose a significant challenge in the management of burn injuries, often leading to functional limitations and psychological distress (17). These


contractures can affect various body parts, including the face, neck, hands, and feet, and may result in long-term complications if not adequately addressed (18). Studies have shown that scar contractures can occur in a significant percentage of burn patients, with prevalence rates ranging from 20.9% to 58.6% post-reconstructive surgery (19). The development of contractures is influenced by factors such as the depth of the burn injury, the timing of surgical intervention, and the type of treatment received (20).




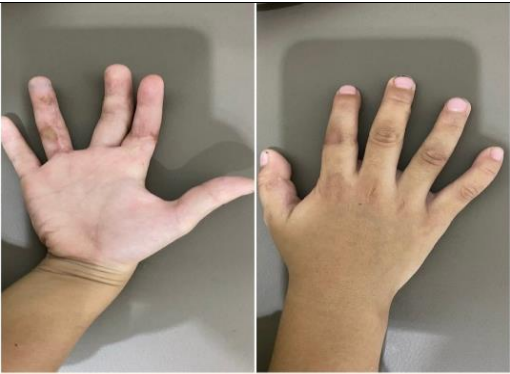
Effective management of burn contractures requires a multidisciplinary approach, involving specialties such as plastic surgery, physiotherapy, and nursing care (21). Surgical interventions, including skin grafting and flap procedures, have been shown to be beneficial in releasing contractures and improving function in affected children (22,23). Additionally, early rehabilitation and the use of orthotic devices have been found to be crucial in preventing and treating contractures, especially in the hands and axilla regions (24–26).

Research has highlighted the importance of post-operative care and follow-up in children with burn injuries to monitor for the development of contractures and ensure optimal outcomes (4,27). Regular check-up examinations and interventions such as scar massage have been recommended to prevent and manage contractures in pediatric burn patients (4,28). Furthermore, the use of innovative techniques like the "Surgical Cuts CO2 Laser Therapy Technique" has shown promise in treating minor burn scar contractures in children (29).

Studies have emphasized the need for early intervention in the management of burn injuries to prevent the development of severe contractures and improve long-term outcomes (30). Factors such as growth patterns in children and the timing of surgical procedures have been identified as critical determinants in the prevention and treatment of contractures (31). Moreover, the use of predictive models, such as nomograms, can aid in assessing the risk of contracture development after skin grafting procedures in burn patients (32).

**III. CASE SERIES**

| Case   | Figure  |
|--|---|
| <p>Case 1. A 10 years-old, male, come with a contracture scar on his right palmar, digiti 2 and 3 manus dextra. With 3 cm scar on his 3rd digiti's proximal to middle phalanx, and 4 cm scar on his 2nd digiti's proximal to distal phalanx.</p> |  |

|   |   |
|---|---|
| <p>Case 2. A 11 years-old, male, come with a contracture scar on his right palmar, digiti 2 and 3 manus dextra. With 2 cm scar on his 2nd digiti's proximal to middle phalanx, and 2 cm scar on his 3rd digiti's middle phalanx.</p>    |    |
| <p>Case 3. A 4 years-old boy, come with a contracture scar on his left palmar, digiti 3 and 4 manus sinistra. With 2,5 cm scar on his 3rd digiti's proximal phalanx and 4 cm scar on his 4th digiti's middle phalanx to metacarpus.</p> |   |
| <p>Case 4. A 11 years-old male, come with a contracture scar on his left palmar, digiti 4 and 5 manus sinistra. With 2 cm scar on his 4th and 5th digiti's metacarpus, and continue to this Zone II.</p>                                |  |
| <p>Case 5. A 6 years-old boy, come with a contracture scar on his right palmar, digiti 4 manus dextra. With 4 cm scar on 4th digiti, start from distal phalanx to his metacarpus regio.</p>   |   |

Case 6. A 7 years-old boy, come with a contracture scar on his right lateral feet. Around 10 centimeters contracture start from



**IV. DISCUSSION**

| No. | Age      | Gender | Description  |
|-----|----------|--------|--|
| 1.  | 10 Years | Male   | 1. Contracture scar on right palmar, digiti II and III manus dextra.<br>2. 3 cm scar on 3rd digiti proximal to middle phalanx<br>3. 4 cm scar on 2nd digiti proximal to distal phalanx |
| 2.  | 11 Years | Male   | 1. Contracture scar on right palmar, digiti II and III manus dextra<br>2. 2 cm scar on 2nd digiti proximal to middle phalanx<br>3. 2 cm scar on 3rd digiti proximal to middle phalanx  |
| 3.  | 4 Years  | Male   | 1. Contracture scar on his left palmar, digiti III and IV manus sinistra<br>2. 2.5 cm scar on 3rd digiti proximal phalanx<br>3. 4 cm scar on 4th digiti middle phalanx to metacarpus   |
| 4.  | 11 Years | Male   | 1. Contracture scar on left palmar, digiti IV and V manus sinistra<br>2. 2 cm scar on 4th and 5th digiti metacarpus and continue to zone II  |
| 5.  | 6 Years  | Male   | 1. Contracture scar on right palmar, digiti IV manus dextra<br>2. 4 cm scar on 4th digiti start from distal phalanx until metacarpus region  |
| 6.  | 7 Years  | Male   | 1. Contracture scar on right lateral feet.<br>2. 10 cm scar on lateral side of feet near lateral malleolus   |

Contractures and hypertrophic scars are the two types of burn scars. If contractures and hypertrophic scars are prevented during the acute phase of burn healing, there will be a better prognosis (33). The cause of postburn contracture formation is multifactorial: 1) injury-related factors include the depth, extent, etiology, and location of burn; 2) patient-related factors include genetic inheritance, race, skin color, age, gender, nutritional status, and compliance with therapy; and 3) treatment-related factors including the type and timing of wound closure, the wound bed, and prevention strategies utilized (15).

Current prevention strategies are primarily composed of static splinting and active/passive range of motion exercises (15). However, static splinting has the potential to cause excessive scar tension, which theoretically increases hypertrophic scarring and therefore contracture. Therefore, the current practice of splinting, especially the initiation, hours of wear and duration of splinting following acute burn injury remains variable (34).

Pediatric burn patients are at significantly increased risk for infection and sepsis secondary to loss of the skin barrier and subsequent immunosuppression (35). Infection causes deeper burns, longer treatment time, and a greater risk of contractures (36). It is leading to huge costs of care and significant physical, psychological, and economic reactions on the burned survivor and their families (37–41).

Both the injury and the burn treatment are known to be painful. Treatment often includes reconstructive surgery and a long rehabilitation period (42). Children may be more likely to experience distress during painful procedures and to engage in uncooperative, non-compliant behaviors (e.g., verbal refusal, flailing), which can result in disruption in medical care, and consequently, prolonged healing, extended hospitalization, and increased risk of infection and post-traumatic stress symptoms. Adequate pain control has been identified as an integral factor in improving long-term burn outcomes, but remains difficult to achieve, especially with younger children (43,44).

The family is of major importance in the social learning of pain (45). Parents, siblings, and others provide considerable instruction through physical guidance, verbal coaching, and opportunities for observational learning (46). Apart from the impact of the injury and its treatment, parents' reaction and responses to the traumatic event have been shown significantly to influence the child's functioning, wellbeing and psychological recovery (47).

Children, especially those under the age of twelve, are still developing. Deformities caused by burns can interfere the limb growth and function. Even if corrective action has been taken for the contracture, it is possible that the contracture will persist if treatment for the burn scar is not adequate (9,48). Skin that has been burned, particularly skin with contractures, will not recover ordinarily. As a result parental support for burn-injured children is an important part of the children's recovery.

## V. CONCLUSION

The sooner burns in children are treated, the better the prognosis. If a contracture has occurred, the treatment requires several stages and function cannot return to normal, but aesthetics can be corrected according to the degree of complexity of the contracture.

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