



Combined Local Flap and Split Thickness Skin Graft (STSG) as One of Reconstructive Surgery Technique for Diffuse Ankle Contracture Management (A Case Report)

Mia Rachmi Widyaningrum^{1*} and Amru Sungkar²

¹General Surgery Resident, Faculty of Medicine Sebelas Maret University, Indonesia.

²Plastic and Reconstruction Surgery Consultant, Dr.Moewardi Hospital, Surakarta, Indonesia.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aims: To describe combined local flap split thickness and skin graft as one of reconstructive surgery techniques for diffuse ankle contracture management.

Case Presentation: A two years old girl with a history of exposure to hot water about one year ago. The patient was diagnosed with a diffuse right ankle contracture. Reconstruction was performed with two operation procedures. At first operation, release of contracture, excision of scar tissue and toe pinning were performed, continued with reconstruction with a local flap (advancement flap) of the inferior area of the medial trunk from the lateral side of ankle, attaching the fiber to the medial side. At second operation, we covered the defect with an intermediate split thickness skin graft (STSG).

Discussion: Contracture is the loss or lack of full range of motion of the joint either passively or actively due to joint limitations, fibrosis of the supporting tissue, muscles and skin. The main concern for contracture therapy is restoration of function by encouraging the use of limbs for ambulation and other activities. Combination between flap and skin graft could be a solution for patient with

*Corresponding author: E-mail: miarachmi19@gmail.com;

contracture. Local flap with random pattern is the most commonly used flap type. Because the process is easier, if the defect area is not too large, this local flap can even be done with local anesthesia. STSG is often used over large areas. Grafts on STSG cover all parts of the epidermis and dermis with different thicknesses. Postoperative evaluation: viable flap, STSG Take 98%.

Conclusion: Combined Local flap and STSG is one of the therapeutic modalities for post burn contracture patients in the ankle joint area which also can prevent recontracture. Regular physiotherapy is still required after this procedure to get maximum range of movement and better walking function.

Keywords: Local flap; skin graft; ankle contracture.

1. INTRODUCTION

Contracture is a persistent contraction of the skin and / or the underlying tissue causing deformity and limitation of movement. This disorder caused due to abnormal scar retraction after wound healing, congenital abnormalities and degenerative processes. The most common contractures are caused by burns [1,2]

The ankle area is an area that does a lot of movement and includes moving joints. If the ankle area is left in a resting position, it triggers contractures. To minimize or prevent contractures in this region, early burn management should prevent contractures with early abduction pedical splints and aggressive physiotherapy followed by active motion exercises to maintain function and minimize secondary deformities. Deep burns of the cruris and pedis may include contractures that limit movement of the ankle joint, particularly abduction and rotation [3-6].

A local flap is a locoregional skin flap, a portion of skin (epidermis plus dermis and subcutaneous tissue) that moves from one area of the body to another, with maintaining its vascularity. Sometimes the flaps can also include the underlying fascia, muscle, or even bone. The removed flap will form new bleeding at the recipient site. This reconstructive operation, is often used to correct defects or abnormalities that arise due to accidents, cheek disorders after tumor surgery), abnormalities in patients who have skin damage due to burns [7,8].

This case report discusses contractures in the right cruric-pedis region due to hot water burns, involving the anterior cruris, ankle and right dorsal pedis, and the management of the reconstruction.

2. PRESENTATION OF CASE

A two years old girl came to Dr. Moewardi Hospital complain that her right leg and ankle were pulled, the joint could not be moved, so she could not walk normally.

The patient had history of burns due to hot water about one year ago. She suffered second degree burns in the area of the abdomen, chest, right arm, left arm, and right leg.

One year later, the patient consulted to the Dr Moewardi Hospital Plastic Surgery Clinic with complaints that her right leg was pulled and the movement was not optimal. To manage her diffuse right ankle contracure, we performed two series of operation.

At first operation, we release the contracture and excision the scar tissue on the anterior cruris and right dorsal pedis, pinning at her right toe, continued with reconstruction a local flap (advancement flap procedure) at inferior area of the medial trunk from the lateral side of the ankle, attaching the fiber to the medial side. At second operation, the defect was covered with an intermediate Split Thickness Skin Graft.

3. DISCUSSION

Burns in children are still a big problem related to post-traumatic events and complications that can arise after primary healing. In this case, the patient had burns after contact with hot water, its compatible to an epidemiological study conducted by Christina, that the cause of the most common burns in children was dominated by hot water as much as 50% of cases which often occur in household accidents, and generally superficial burns, but can also affect the entire thickness of the skin (third degree). Fire burns accounted for 14% of cases of electrical injury 1%, chemical burns 1% and other residual consequences [1].



Fig. 1. Patient's right leg, before the reconstruction procedure (Courtesy of Amru Sungkar)

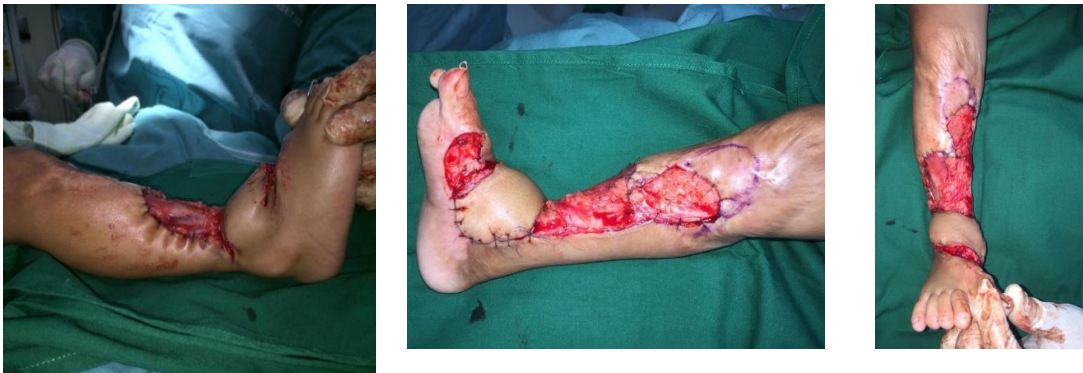


Fig. 2. The first operation: Release contracture, scar excision and local flap procedure (Courtesy of Amru Sungkar)



Fig. 3. Second operation: Performed skin graft with intermediate STSG (Courtesy of Amru Sungkar)



Fig. 4. Two weeks after the skin graft, we performed medication, STSG evaluation and aff pinning. Result : Viable flap, and STSG take 98% (Courtesy of Amru Sungkar)



Fig. 5. One month after surgery, the patient was able to stand up and learn to walk. Right leg ankle normal, no re-contraction (Courtesy of Amru Sungkar)

In this case, the patient suffered second degree burns to the affected area, chest, right and left hand, right and left leg. About one year after given initial management, she complained that her right leg and ankle were pulled, and her joints could not be moved. After undergoing examination at Dr Moewardi Hospital, she was diagnosed with a diffuse right ankle contracture. According to Kenji *et al* article, burn contractures are the loss or lack of motion of a passive or active joint due to joint limitations, fibrosis of the supporting tissue, muscles and skin [2].

Regarding the pathogenesis, joint contractures caused by changes in soft tissue around the joints, and muscle changes associated with immobilization. However, the mechanisms

underlying muscle contractures are unclear. Therefore, this study investigated changes in muscle extensibility and collagen expression, and examined the molecular mechanisms underlying muscle contractures of the soleus muscle at immovable sites. Macrophages, IL-1 β , TGF- β 1, and collagen type III increased with immobilization for 1 week, but were unchanged after a long period of immobility. Levels of myofibroblasts and collagen type I also increased with immobilization for one week and then increased after four weeks of immobilization [3].

In the burn case with extensive contractures where the scar tissue consists of extensive fibrous tissue, partial excision of the scar tissue is required by removing / exposing the blood

vessels and nerves without being covered with fatty tissue, then a flap transplant is performed to cover the defect. Another indication of flap use is failure to use a free graft method for correction of previous contractures. The flap can be rotated from the network close to the defect in one job [4].

In this patient, after excision of the scar tissue, the defect in the joint area was covered by a flap. The flap taken is a type of local flap from the tissue in the right leg medial from the defect, with an advancement flap type of movement, the flap is slightly rotated to the right about 70 degrees. The flow of bleeding for this flap is a random pattern (Randomi pattern flap), which is a flap that does not have a specific blood vessel at the base of the flap [5,7]

Local flap is a flap taken from the tissue adjacent to the primary defect. Local flap with random pattern is the most commonly used flap type. Because the process is easier, if the defect area is not too large, this local flap can even be done with local anesthesia. The better the blood flow in the flap area, the better the survival rate, the better the success rate [8,9].

After releasing the contracture, excision of scar tissue, and reconstruction with a local flap, in the next operation, the remaining open defect was covered by a split-thickness skin graft. STSG is often used over large areas. Grafts on STSG cover all parts of the epidermis and dermis with different thicknesses. STSG is classified into three groups, namely thin STSG (0.005-0.012 inch), intermediate (0.012-0.018 inch) or thick STSG (0.018-0.030 inch), based on the thickness of the graft taken. In this patient the graft used was intermediate STSG [10,11].

In this patient, the STSG donor was taken in the upper left thigh. Selection of the appropriate donor site must consider the size of the graft to be removed, whether or not the donor location can be hidden, and the ease of accessing the donor site for follow-up. The most common sites for STSG donors are taken from the upper thighs, buttocks, and abdominal wall. The donor site can improve spontaneously due to the presence of remaining epidermal components and can be transplanted when it is completely healed [5,12,13].

STSG has several weaknesses that must be considered because it is more vulnerable, besides that STSG also experiences contractions

during the healing process and does not grow with age. STSGs also tend to experience abnormal pigmentation (either pale or whitish) or hyperpigmented. These drawbacks cause STSG to be more helpful in functional rather than aesthetic terms [5,12,13].

After undergoing a series of procedures to treat contractures in the left ankle, this patient obtained a viable flap and a 98% STSG foot take. This is a very good achievement. However, additional therapy is still needed to prevent re-contractures.

Post-burn contractures (PBC) are a distressing problem in both the developed and developing worlds. They usually occur following inadequate primary burn injury management. Children are the most affected by PBC, and the elbow and shoulder joints are the most involved regions. According to research conducted by Carmichael et al. stated that the ankle joint had a high frequency of recurrence [13]. In another study explained that the anatomical and functional peculiarities of the ankle joint, which is characterized by its complex structure and the absence of protective adipose and muscular tissue, may be the reason for contracture recurrences [14].

Physiotherapy is an appropriate follow-up to prevent contractures. For the handling of this patient, we collaborate with the Department of Medical Rehab. Physiotherapy measures in patients after burns include: [4,5,15]

- a. **Proper Positioning:** Proper positioning can prevent contractures and this should be maintained throughout the time the patient is in bed. At the ankle joint its proper positioning is dorsiflexion.
- b. **Exercise:** The goal of exercise is to maintain the range of motion of the joint and prevent contractures. Exercise can be done by stretching the joints (free active exercise), it can also be with the help of medical personnel (active assisted exercise) or passive exercise.
- c. **Stretching:** Mild contractures are stretched for 20-30 minutes, whereas severe contractures are stretched for 30 minutes or more in combination with proper positioning. Standing is the best stretching, standing straight is effective for stretching the front hip and back knee.
- d. **Splinting/Bracing:** Considering the scope of joint motion, exercise and positioning

are important things to take attention in burns, to maintain a good position during sleep or fight tissue contraction, especially in patients who experience pain and confusion.

- e. **Heating:** For muscle and joint contractures caused by scars caused by burns, ultrasound is the best warm-up, giving it for 10 minutes per field. Ultrasound is the modality of choice for all joints covered by soft tissue, whether small or large joints [4,5,15].

4. CONCLUSION

Combined Local flap split thickness and skin graft is one of the therapeutic modalities for post burn contracture patients in the ankle joint area which also can prevent recontracture. Regular physiotherapy is still required after this procedure to get maximum range of movement and better walking function.

CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard guideline ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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