e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(11); 542-545

Original Research Article

A Hospital-Based Assessment of Yang's Onion Flap Technique for Release of Scarred Eponychium and Nail Fold Reconstruction in Burn Patients: An Observational Study

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Received: 04-08-2023 / Revised: 20-09-2023 / Accepted: 16-10-2023
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Conflict of interest: Nil

Abstract:

Aim: In the present study, we used an onion flap to release scarred eponychium and nail fold reconstruction in a single stage without using soft tissue from another area.

Methods: We conducted a prospective interventional study from December 2017 to August 2020. A total of 50 fingers (20 patients) were operated on.

Results: The mean age of patients was 32.8 years. The mean time interval since burn injury to surgery was 18.6 months, with a range of 7 to 47 months. 38 fingers had flame burns, while 12 had scald injuries. Out of 50 patients, 12 (24%) were operated on for other contractures under general anesthesia, and Yang's flap was done simultaneously, while 38 patients (76%) were operated under local anesthesia under digital or wrist block. Of 20 fingers with symptoms, 16 fingers (80%) reported a symptomatic relief, while six fingers reported no symptomatic relief at the end of follow-up period.

Conclusion: Yang's flap is a good option for the correction of nail deformity in burn patients. It was associated with a low complication rate and improved nail appearance in the patients. There is also significant symptomatic relief in performing daily activities after surgery.

Keywords: onion flap, post-burn nail deformity, nail fold reconstruction

Introduction

A burn ensues after the skin is damaged by heat, radiation, electricity, or chemicals. Serious complications of deep or widespread burns can happen, e.g., sepsis due to bacterial infection, shock caused by hypovolemia, or scaring tissue contraction after improper wound healing. The skin damage causes the death of skin cells, leading to an enormous loss of body fluids that is followed by dehydration, electrolyte imbalance, and renal and circulatory failure. Another serious threat to lives of burn patients is an infection. The burned skin is extremely susceptible to bacteria and other pathogens, due to the loss of protection by intact layers of the skin. Each of these complications can be fatal or make a patient suffer. Therefore, it is critical to promptly cover a burn injury using an appropriate approach to prevent them and save patients' lives, besides providing intravenously fluids and nutrients to offset dehydration and replace lost proteins. The survival rates of patients with burns have significantly improved due to the application of various skin grafts over the last decades. Despite wide use, autologous skin grafts are deficient in the treatment of severe burns for patients with limited donor site area. [1,2] Skin substitutes, especially cell-based ones, play critical role in overcoming this scarcity. The cumulative effect of cell-sheets, scaffolds, cell-scaffolds, and hydrogels with healing promoting factors triggers, accelerates, and enhances wound healing and re-epithelialization that leads to a reduction in scar formation and prevention of burn injury complication. Skin substitutes have shown high

efficacy and cost-effectiveness compared to autologous skin replacement. [3,4]

The skin plays an important role which cannot be overestimated; its functioning ensures homeostasis and protects us from aggressive and causative agents in the environment. It is constantly involved in numerous processes: water balance and temperature regulation, signal perception, hormone, neuropeptide and cytokine production and activation, etc. [5] The skin is formed by three main layers (the epidermis, the dermis, and the hypodermis) with its appendages (hair, sweat and sebaceous glands, sensory neurons, blood and lymph vessels, etc.). [6] The entire skin tissue contains various cells (epidermal, stromal, endothelial, and neuronal cells) and the extracellular matrix (ECM). Cells, growth factors, and matrix are the basic elements for use in the skin regeneration and replacement after an injury. [7]

In the present study, we used an onion flap to release scarred eponychium and nail fold reconstruction in a single stage without using soft tissue from another area.

Materials and Methods

We conducted a prospective interventional study from December 2017 to August 2020 at Nalanda Medical College and Hospital, Patna, Bihar, India. A total of 50 fingers (20 patients) were operated on. Inclusion criteria were patients of burn nail deformity due to retracted eponychium after burns. Exclusion criteria were patients previously operated for burn nail deformities, nail deformity other than burn injury, less than 18 years of age, and those with infected nailbeds and local ulcers.

Methodology

Patients attending the outpatient department as well as inpatients were screened for nail deformities. A total of 44 nail deformities were operated upon. All cases were done under general or local anesthesia, and the onion flap procedure as described by Yang et al [8] was followed to reconstruct the burn nail deformity.

Surgical Technique

All fingers were operated under tourniquet control for ease of dissection. Flap markings were designed by marking the existing eponychial edge and then the projected eponychial edge. This gap was restored by advancing the onion flap raised on residual eponychium superficial to underlying tendons. The bipedicled advancement flap was planned with lateral bases of at least 5 mm in width. The onion flap tip was usually planned 1 mm more than the desired advancement and was kept narrow to allow primary closure. An anchoring suture was taken from the distal end of the flap to the nail pulp. Yang did not initially describe this suture, but we found it to be a worthwhile modification.

Viability of flap, hematoma, and infection were recorded in the early postoperative period. The parameters assessed and recorded till 4 months of follow-up were final donor site scar appearance, assessed by visual analog scale (VAS) (0: unacceptable scar to 10: natural appearance),3 and nail plate appearance, such as the direction of nail growth and the smoothness of the nail plate, assessed using clinical examination and photographs.

Statistical Analysis

All data were subsequently analyzed with the help of computer software (SPSS statistical software, version 25.0, for Microsoft Windows, SPSS Inc. Chicago, IL). All values were expressed as mean and percentages. Qualitative data correlation was done by Chi-square test. The quantitative data correlation was done by t-test.

Results

Table 1: Patient details

Variables	
Mean age	32.8 years
Mean time interval since burn injury to surgery	18.6
Range	7-47 months
Burn injuries n (%)	
Flame burns	38 (76)
Scald injuries	12 (24)
Patients operated n (%)	
Yang's flap under general anesthesia	12 (24)
Yang's flap under local anesthesia	38 (76)
Symptomatic relief	
Yes	16 (80)
No	4 (20)

The mean age of patients was 32.8 years. The mean time interval since burn injury to surgery was 18.6 months, with a range of 7 to 47 months. 38 fingers had flame burns, while 12 had scald injuries. Out of

50 patients, 12 (24%) were operated on for other contractures under general anesthesia, and Yang's flap was done simultaneously, while 38 patients (76%) were operated under local anesthesia under digital or wrist block. Of 20 fingers with symptoms, 16 fingers (80%) reported a symptomatic relief, while six fingers reported no symptomatic relief at the end of follow-up period.

Discussion

Abnormalities of fingernail growth and appearance are among the most common deformities encountered after burn injury to the hand. Abnormalities of the burnt nail apparatus can be divided into (a) intrinsic, resulting from direct thermal damage to the regenerative nail matrices and (b) extrinsic, because of contracture of the soft tissues proximal to the eponychium. [7] The severity of the nail deformity is usually proportional to the degree of the nailfold proximal dislocation and can be roughly determined by the extra amount of visible lunula.

Various techniques used for resurfacing defects include incision of the scarred eponychium and advancement of the distal segment, flap reconstruction by either distally or proximally based transposition or advancement flaps, composite graft techniques, and microvascular transfer.1 All these techniques demand a secondary donor site and its associated morbidity, except small advancement flaps where the donor site may be closed primarily. Small advancement flaps or rotation flaps cannot be used for moderate or severe types of nail fold contractures. Some procedures are associated with poor cosmetic appearance, pulp-to-pulp, and lateral-to-pulp (key) pinches that are uncomfortable. [8] The mean age of patients was 32.8 years. The mean time interval since burn injury to surgery was 18.6 months, with a range of 7 to 47 months. 38 fingers had flame burns, while 12 had scald injuries. Out of 50 patients, 12 (24%) were operated on for other contractures under general anesthesia, and Yang's flap was done simultaneously, while 38 patients (76%) were operated under local anesthesia under digital or wrist block.

Achauer et al used a primarily closed donor site, but the procedure could only be applied to mildly deformed nails. The author later favored proximally based flaps for nail deformities and nail fold creation. [9] Distally based flaps have a risk of precarious blood supply if they are raised very distally, and the digital nerve and vessels can be damaged while raising the flap leading to a decreased sensation and flap loss. [7,10] The proximally-based flaps can have a digital artery or branch included in the flap, but the flap still has the chance of digital nerve injury. This risk is because earlier flaps included skin from the finger's lateral side, which often encroached on the volar aspect. When raised, both proximal and distally based flaps should preserve the pulp-to-pulp pinch area (the flap is raised on the nondominant ulnar border of the fingers and the radial border of the thumb). However, it may not always be possible due to scarring of the skin in the involved finger. [10]

Donelan et al [11] performed release of scarred tissue and closure of the resultant defect by a skin graft, the flap used by them for nailfold reconstruction also settled with time as seen in the postoperative photographs by the patients. Achauer [12] also reported flattening of dorsal flaps over time. This previously documented flattening out of the flap was also seen in our study. Because the donor site was closed primarily in our study, we did not notice a different color of the donor site as seen in the report of Donolen et al. [11] Of 20 fingers with symptoms, 16 fingers (80%) reported a symptomatic relief, while six fingers reported no symptomatic relief at the end of follow-up period. Spauwen also reported symptomatic improvement in all patients operated. Though the effects of surgery reversed at the end of 1 year in their study, patients still reported symptomatic relief at the end of 1 year. [13]

Conclusion

Yang's flap is a good option for the correction of nail deformity in burn patients. It was associated with a low complication rate and improved nail appearance in the patients. There is also significant symptomatic relief in performing daily activities after surgery.

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