

EVALUATION OF TREATMENT RESULTS OF 10 PATIENTS WITH SOFT TISSUE DEFECTS IN THE WRIST-HAND REGION USING RADIAL ARTERY PERFORATOR FLAPS

Vu Quoc Khanh^{1*}, Hoang Thanh Tuan²
Vu Quang Vinh², Tran Van Anh²
Do Trung Quyet¹, Hoang Tuan Hoang²

ABSTRACT

Purpose: Evaluate the treatment results of soft-tissue defects in the wrist-hand region by radial artery perforator flaps.

Subjects and methods: A prospective, non-controlled study and cross-sectional description of 10 patients with soft-tissue defects in the wrist-hand region due to burns, indicated for reconstructive treatment using radial artery perforator flaps at the Center for Plastic and Aesthetic Surgery, Le Huu Trac National Burn Hospital, from January to September, 2021.

Results: Patients aged between 17 and 69, mean age of 37.3 ± 14.5 years; ratio of male patients to female patients was 4/1. Regarding the location of injuries: 9 patients had soft-tissue defects in the dorsum of the wrist-hand; 1 patient had a soft-tissue defect in the volar aspect of the wrist-hand. Regarding treatment results: 8 patients showed excellent treatment results, 2 patients had satisfactory results, and there were no cases of treatment failure.

Keywords: Radial artery perforator flap, wrist-hand soft-tissue defects due to burns.

Corresponding author: Vu Quoc Khanh; Email: cyberpaladin93@gmail.com

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¹Military Hospital 103.

²Le Huu Trac National Burn Hospital.

1. INTRODUCTIONS

The hands and fingers have a complex and delicate structure, undertake many extremely important functions in human life. However, recent health statistics indicated an increase in the number of accidents causing injuries to the structures of the wrist-hand region, particularly involving skin loss, subcutaneous tissue loss, and exposure of bones on the dorsal and volar aspects of the hand and fingers. These are complex defects that pose challenges in selecting appropriate covering methods but are essential for early surgical intervention to preserve the viability of tendons and bones, preventing functional loss in the hand.

The radial artery perforator flap (RPF) is a vascularized tissue flap with a vascular pedicle (good nourishing capacity for the flap), meeting the demand for covering skin loss in the wrist-hand region without sacrificing the radial artery perforator, minimizing additional trauma at the flap donor site. Therefore, the radial artery perforator flap is one of the choices for treating soft-tissue defects in the wrist-hand region.

We carried out this study to evaluate the surgical results of treating soft-tissue defects in the wrist-hand region using radial artery perforator flaps.

2. SUBJECTS AND METHODS

2.1. Subjects

Ten patients with soft-tissue defects in the wrist-hand region due to deep burns, indicated for reconstructive treatment using radial artery perforator flaps at the Center for Plastic and Aesthetic Surgery, Le Huu Trac National Burn Hospital, from January to September 2021.

- Selection criteria: patients with soft-tissue defects in the wrist-hand region due to burns, ineligible for skin grafting, or unable to undergo microsurgery.

- Exclusion criteria: patients with skin loss over one-third of the middle or upper forearm; patients with soft-tissue defects lacking viable tissue supplied by radial artery perforators; patients unwilling to participate in the study.

2.2. Methods

- Study design: prospective study, non-controlled cross-sectional description.

- Research criteria: characteristics of the patients (age, gender, injury location), wound size, flap size, results of treatment.

- Research procedures:

+ Surgery: precise excision of the wound, removal of all foreign bodies, maximal preservation of healthy tissue, measurement of the defect size.

+ Flap design: analysis of the wound, selection of an appropriate flap design method (position, method of flap utilization, aesthetic aspects of flap design, ability to reconstruct both function and aesthetics), including:

* Drawing the course of the radial artery perforator from the midpoint of the wrist fold to the radial styloid process. Using handheld doppler ultrasound to identify and mark the location of the perforator branches of the radial artery (usually located 1.5-2 cm from the radial styloid process where significant radial artery perforator branches can be found).

* Flap size: designing an elliptical-shaped flap with dimensions corresponding to the defect size. Ensuring the flap width is slightly larger (1-2 cm) than the defect size to avoid flap contracture, but taking the minimum width equal to the defect width.

* Flap elevation: after determining the exit point of the radial artery perforator branches and the pivot point of the flap, the flap is raised from the peripheral edge of the vascular pedicle to the central position. The flap structure included the skin layer, subcutaneous tissue, and adipose tissue. The closer to the vascular pedicle, the more meticulous dissection is required, combining Doppler ultrasound to determine the position and condition of the perforator branches (peripheral branches were ligated and excised). When the nourishing pedicle of the flap is secured, the entire flap is raised in all directions. Garo release, assessment of blood supply to the flap, and suturing the flap securely into the defect.

+ Harvesting full-thickness skin from the groin or thin skin from the inner thigh with a size equivalent to the flap's location. Gently fix the grafted skin onto the flap, sew the edge of the grafted skin to the location for the flap, apply vaseline gauze, fix the moist gauze, and bandage the wound.

- Evaluation of treatment results:

+ Excellent: Flap skin viability is good.

+ Satisfactory: Necrosis at the flap tip is less than 1 cm, requiring revision or subsequent thin skin grafting.

+ Fair: Necrosis involving half of the flap.

+ Poor (failure): Complete necrosis of the flap skin.

- Research ethics: patients had clearly explained the study's purpose, understood and agreed to participate in the research. All patient's information was kept confidential and used solely for research purposes.

- Data analysis: using SPSS 22.0 software.

3. RESULTS

3.1. Characteristics of study subjects:

- Age: patients ranged from 17 to 69 years old, with an average age of 37.3 years.

- Gender: eight patients (80.0%) were male, and two patients (20.0%) were female. The male-to-female patients ratio was 4:1.

- Causes of injury:

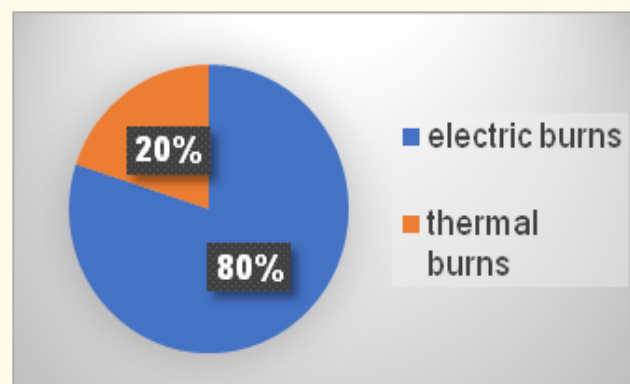


Chart 1. Distribution of patients according to the causes of injury

The causes leading to soft-tissue defects in the dorsum and volar aspect of the hand were predominantly electric burns (80.0%) and thermal burns (20.0%).

3.2. Characteristics of injuries

Table 1. Distribution of soft-tissue defects according to the injured hand

Injured hand	No. of patients	Percentage %
Right	6	60.0
Left	4	40.0
Total	10	100.0

Among the 10 study participants, 6/10 patients had soft-tissue defects in the right hand, and 4/10 had soft-tissue defects in the left hand. There were no cases of defects in both hands.

Table 2. Distribution according to the location of injury (n = 10)

Location of injury	No. of patients	Percentage %
Palm of wrist - hand	9	90.0
Dorsum of wrist - hand	1	10.0
Both palm and dorsum of hand	0	0

The majority of soft-tissue defects located in the Palm of wrist - hand (9/10 patients, accounting for 90.0%). This is a location that easily exposed important structures and is susceptible to infection when the soft-tissue defects occurred. At the same time, treatment to cover defects in this area was difficult..

- Size of Injuries: the smallest soft-tissue defect measured was 6 cm², the largest was 48 cm², with an average of 16.9 ± 12 cm².

- Size of skin flap: ranged from 15-78 cm², with an average of 32 ± 9.89 cm².

Table 3. Postoperative complications

Complications	No. of patients	Percentage %
No complications	1	10.0
Seroma	3	30.0
Bleeding	2	20.0
Infection, wound dehiscence, delayed healing	1	10.0
Partial flap necrosis	3	30.0
Complete flap necrosis	0	0

After surgery, complications encountered included seroma (30.0%), bleeding (20.0%), infection, wound dehiscence, delayed healing (10.0%), and partial flap necrosis (30.0%). There were no cases of complete flap necrosis. In particular, there was one case without complications after surgery.

- Treatment results (n = 10):
- + Excellent: 8 patients (80.0%).
- + Good: 2 patients (20.0%).
- + No cases of treatment failure.

4. DISCUSSIONS

- Age: the age distribution of patients ranged from 17 to 69 years, with an average of 37.3 years. Bui Thanh Tuan's study in 36 patients using local flaps and artery-based flaps to cover defects in the hand region found that the age distribution of patients ranged from 2 to 52 years, with an average age of 27.6 years, of with individuals aged 18-40 accounting for 50% [1]. This is reasonable because this is the age when people are energetic, participate in work and have many activities in society and in the community, so the risk of hand injury is often higher.

- Gender: among the 10 cases in our study, 8 were male patients and 2 were female patients, resulting in a male-to-female ratio of 4:1. This result was consistent with the study by Huynh Tan Thinh (male-to-female ratio of 3.16) [2]. Another study by

Alper Ural found a male-to-female ratio of 7:1 [3]. This can be explained by the higher participation of males in manual labor and general artistic activities, leading to a higher risk of hand injuries.

- Causes of injury: 80.0% of the injuries caused by electric burns, while 20.0% were due to thermal burns. When studying the causes of soft-tissue defects in the hand region, various classifications were employed. For example, Nguyen Duc Tien's research evaluating the reconstruction of finger defects using local continuous flaps identified the main cause of finger injuries was occupational accidents (64.3%) [4].

- Location of soft-tissue defects: defects in the palm of wrist - hand accounted for 90.0%, while defects in the dorsum of wrist - hand accounted for 10.0%. This is a vulnerable location where important structures easily exposed, increasing the risk of infection, and treatment to cover defects was difficult. Nguyen Tan Bao An's study found that 75% of soft-tissue injuries occurred in the palm of the wrist - hand while the remaining 25% were in the dorsum of the hand [5]. Vo Van Phuc's study of 34 patients showed that 76.5% of soft-tissue injuries were in the anterior forearm, 14.6% in the posterior forearm, and 8.9% involved both the anterior and posterior aspects of the forearm [6]. During the work, the front of the hand is the part that performs the main movements and main contact, so the injury rate is higher than the dorsum of the hand; our research results were similar to the above research results.

- Size of injuries: the size of defects ranged from 4 cm² to 48 cm², with an average of 16.9 ± 12 cm². Vo Van Phuc found that the size of defects ranged from 4-80 cm², with an average of 34.97 cm²; 91.2% of patients had defect sizes ranging from 20-42 cm² [6]. According to Vu Minh Hiep, 93.48% of cases had defect sizes under 100 cm², with an average defect size of 59.89 ± 22.56 cm² [7]. Although our study encountered smaller average defect sizes compared to other studies, it may be attributed to the small sample size, with injuries primarily concentrated in the wrist area.

- Flap size: in our study, flap sizes ranged from 15-78 cm², with an average of 32 ± 9.89 cm². A study by Kazufumi found flap sizes ranging from 26-90 cm², with an average size of 51 cm² [8]. Vo Van Phuc found that the largest flap size was 105 cm², the smallest was 8 cm² with an average of 58.21 cm² [6]. As can be seen, the average flap size in our study was smaller than other authors. This may be because the injuries of the patients in the study mainly concentrated in the wrist area, so the defect area was small. In addition, the main injury of the patients was due to electrical burns, while other authors said the cause of injury included trauma,

so the extent of injury was greater, thus the need to use a flap to cover also required a larger area.

- Treatment results: In our study, 8/10 patients achieved excellent results, 2/10 had good results, and there were no cases of partial or complete flap necrosis. These results were comparable to the study by Do Luong Tuan (excellent: 77.42%, good: 19.5%) [9].

The perforator flap is a valuable skin-fascia flap in the treatment of anterior and medial soft tissue defects in the wrist, and can be performed at the primary level.

This is a method to limit major, more complicated surgeries when the patient does not have the conditions or the injury does not require skin grafting. Although the study sample size was small, these initial results were very encouraging. We believe that more studies are needed to evaluate similarities with a larger number of samples.

5. CONCLUSIONS

Study on the 10 patients with soft-tissue defects in the wrist-hand region due to deep burns, treated with reconstruction using radial artery perforator flaps, at the Center for Plastic and Aesthetic Surgery, National Institute of Burns Le Huu Trac, from January to September 2021, concluded:

- The patients' ages ranged from 17 to 69 years, with an average ages of 37.3 ± 14.5 years; the male-to-female ratio was 4:1.

- 90.0% of patients had soft-tissue defects in the palm of wrist - hand, while 10.0% had defects in the Dorsum of wrist - hand

- Treatment results: 8/10 patients (80.0%) achieved excellent results, 2/10 patients (20.0%) had good results, and there were no cases of treatment failure.

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ILLUSTRATIVE IMAGES



Debridement of the wound



Flap dissection



Securing the flap into the defect



Treatment results after 3 months