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RESULTS OF SKIN GRAFT SURGERY IN THE TREATMENT OF SOFT TISSUE DEFECTS DUE TO TRAUMA AT THE DEPARTMENT OF PLASTIC AND AESTHETIC SURGERY IN 2024

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ABSTRACT

Objectives: To describe the clinical and paraclinical characteristics of patients with soft tissue defects due to trauma. To evaluate the outcomes of skin graft surgery in the treatment of post-traumatic soft tissue defects at the Department of Plastic and Aesthetic Surgery, Hanoi Medical University Hospital, in 2024.

Subjects and Methods: A prospective, descriptive, non-controlled study was conducted on 99 patients with soft tissue defects resulting from traffic accidents, occupational injuries, or domestic accidents. All patients underwent autologous skin grafting at the Department of Plastic and Aesthetic Surgery between June and December 2024. Data were collected from medical records and postoperative follow-up and analyzed using descriptive statistical methods.

Results: Patients aged 20–60 accounted for the highest proportion (54.55%), with males representing 53.54%. The most common cause of injury was traffic accidents (59.6%). The most frequently affected sites were the foot (44.4%) and the lower leg (34.3%). Split-thickness skin grafts were more commonly used (60.61%). The reasonable graft survival rate was 91.92%, and wound healing mainly occurred within 8–12 days (66.67%). The complication rate was low (7.07%). After 3 months, 61.62% of patients had normal sensation at the graft site, and 62.63% had limited joint mobility.

Conclusion: Autologous skin grafting is an effective method for treating post-traumatic soft tissue defects, demonstrating a high graft survival rate, short healing time, and relatively good functional recovery. The findings support the improvement of clinical treatment protocols in plastic surgery departments.

Keywords: Skin graft, soft tissue defect, traumatic injury, graft survival, functional recovery, plastic surgery.

1. INTRODUCTION

Traffic, occupational, or daily life accidents often cause severe soft tissue injuries, leading to extensive skin and soft tissue defects. Among these, skin loss is a common type of injury frequently encountered in trauma emergencies and reconstructive surgery[1]. Large skin loss wounds are difficult to heal on their own and require timely coverage to protect the injured area, prevent infection, reduce fluid loss, and restore both function and aesthetics[1,2].

Autologous skin grafting is an effective method for reconstructing defects caused by trauma, burns, or chronic ulcers. This technique enables rapid skin coverage, reduces the risk of infection, promotes

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wound healing, and enhances both functional and aesthetic outcomes. When performed on a clean wound bed with proper postoperative care, the survival rate of grafts can reach approximately 90%[3]. A study on thick skin grafting in the lower extremities reported a complete graft survival rate of 90%, with only 2.5% of complete graft necrosis, and an infection complication rate of approximately 11%[3]. However, in poorly perfused areas or patients with underlying conditions, the infection rate may rise to 10–20%, with hematoma or seroma accounting for 5–10% of these cases[4].

In Vietnam, there is a lack of systematic research on the effectiveness of skin grafting in treating soft tissue defects caused by trauma. Therefore, evaluating skin graft outcomes, with a focus on graft take rate and complications, is essential to provide practical evidence and improve treatment quality in this field. We conducted the study titled: *"Results of skin graft surgery in the treatment of soft tissue defects due to trauma at the department of plastic and aesthetic surgery in 2024"* with two main objectives:

1. Describe the clinical and paraclinical characteristics of patients with traumatic soft tissue defects

2. Evaluate the outcomes of skin grafting surgery for post-traumatic soft tissue defects at the Department of Plastic and Aesthetic Surgery, Hanoi Medical University Hospital in 2024

2. MATERIALS AND METHODS

2.1. Research Subjects

- Inclusion Criteria

+ Patients with soft tissue defects resulting from traffic accidents, occupational accidents, or domestic accidents who underwent skin grafting surgery at the Department of Plastic and Reconstructive Surgery, Hanoi Medical University Hospital.

+ Complete medical records.

+ Provided consent to participate in the study

- Exclusion Criteria:

+ Incomplete medical records.

+ Skin and soft tissue defects with active infection or associated with exposed bone, tendon, or joint capsule.

2.2. Research Design

Descriptive non-controlled prospective research method

2.3. Time and Location of the research

Research time: 6/2024-12/2024

Research location: Department of Aesthetic Plastic Surgery, Hanoi University of Medicine and Pharmacy.

2.4. Sample Size and Sampling Method

The study was conducted on 99 patients with skin and soft tissue defects treated with thick skin grafting or split-thickness skin grafting at the Department of Plastic and Reconstructive Surgery, Hanoi Medical University Hospital.

Sampling Method: All patients who consented to participate in the study from June 2024 to December 2024 were included in the analysis.

2.5. Research variable

Objective 1: Describe the clinical and paraclinical characteristics of patients with traumatic soft tissue defects

- General Information: Age, gender, residential area, cause of trauma

- Clinical and Paraclinical Features: Location of the injury, time from trauma to hospital admission, area of skin loss, characteristics of the injury (necrosis, skin loss, post-fasciotomy), associated injuries (fractures, vascular injuries, other traumas).

Objective 2: Evaluate the outcomes of skin grafting surgery for post-traumatic soft tissue defects at the Department of Plastic and Aesthetic Surgery, Hanoi Medical University Hospital in 2024

- Surgical Techniques: Surgical method (immediate grafting or post-debridement grafting), type of skin graft (thick or split-thickness), number of grafting procedures, donor site location.

- Treatment Outcomes: Length of hospital stay, time to wound healing, graft complications, graft survival rate.

- Three-Month Follow-Up Evaluation: Sensation in the grafted area, skin color, scar condition, range of motion.

2.6. Data Analysis

Data were entered using Microsoft Excel and analyzed using STATA 17.0 software. Descriptive statistics were used to report the frequency and percentage of categorical variables. The chi-square test was employed to assess differences between factors, with statistical significance set at $p < 0.05$.

2.7. Research Ethics

Hanoi Medical University Hospital approved the research. All patient information was kept strictly confidential and used solely for research purposes.

3. RESULTS

3.1. General information about the research subject

Table 1. General information about the research subject

General information		Frequency	Ratio
Age	<20	14	14.14
	20-60	54	54.55
	>60	31	31.31
Gender	Male	53	53.54
	Female	46	46.46
Residential area	Urban	22	22.22
	Rural	77	77.78
Cause of trauma	Traffic Accidents	59	59.6
	Work Accidents	23	23.23
	Domestic Accidents	17	17.17

Table 1 indicates that the 20–60 age group accounted for the highest proportion (54.55%). Males represented 53.54% of the study population, while females accounted for 46.46%. The majority of patients resided in rural areas (77.78%). The most common cause of trauma was traffic accidents (59.6%), followed by occupational accidents (23.23%) and domestic accidents (17.17%).

3.2. Clinical and paraclinical features

Table 2. Clinical and paraclinical characteristics of the study subjects

		Frequency	Ratio
Location of the lesion	Forearm	18	18.18
	Upper arm	8	8.08
	Hand	9	9.09
	Thigh and knee	14	14.14
	Lower leg	34	34.34
	Foot	44	44.44
	Head, face, and neck	2	2.02
Time from injury to hospital admission	<24 Hour	87	87.88
	1 -14 days	8	8.08
	14-21 days	1	1.01
	>21 days	3	3.03
Area of skin loss	<150 cm^2	58	58.59
	150-450 cm^2	25	25.25
	450 - 900cm^2	9	9.09
	>900 cm^2	7	7.07
Characteristics of the injury	Soft tissue necrosis	19	19.19
	Skin-loss wound	74	74.75
	Skin defect following fasciotomy	8	8.08
Associated injuries	No associated injury	38	38.38
	Bone fracture	58	58.59
	Vascular injury	10	10.10
	CTSN	3	3.03
	Chest CT	1	1.01

The most common sites of injury were the foot (44.44%) and the lower leg (34.34%). The majority of patients were admitted to the hospital within 24 hours after the injury (87.88%). The area of skin loss was predominantly less than 150 cm^2 (58.59%). The most frequent injury characteristic was a skin-loss wound (74.75%). Bone fracture was the most common associated injury (58.59%).

3.3. Surgical characteristics

Table 3. Surgical characteristics of the study subjects

		Frequency	Ratio
Surgical Method	Immediate skin grafting	32	32.32
	Debridement followed by skin grafting	67	67.68
Coverage Method	Thick skin grafting	39	39.39
	Split-thickness skin grafting	60	60.61
Number of Grafting Procedures	1 time	91	91.92
	2 times	8	8.08
Donor Site Location	Upper limb	1	1.01
	Lower limb	98	98.99

The majority of patients underwent debridement prior to skin grafting (67.68%), with split-thickness skin grafts being the more commonly used technique (60.61%). Skin grafting was primarily performed in a single session (91.92%), with donor sites almost exclusively located on the lower limbs (98.99%).

3.4. Treatment results

Table 4. Treatment outcomes of the study subjects

	Frequency	Ratio
Hospitalization time after skin grafting		
<7 days	19	19.19
7 – 14 days	54	54.55
14 – 21 days	16	16.16
>21 days	10	10.1
Healing time of the skin		
8-12 days	66	66.67
>12 days	33	33.33
Complications of skin grafts		
No	92	92.93
Displaced fragments	7	7.07
The survival rate of skin grafts		
Good	91	91.92
Medium	8	8.08
Poor		
Skin graft sensation (after 3 months)		
Ordinary	61	61.62
Sensory disturbances	38	38.38
Sensory loss		
Skin graft color (after 3 months)		
Dark	96	96.97
Light	1	1.01
Ordinary	2	2.02
Scar condition (after 3 months)		
Keloid	43	43.43
Depressed Scars	1	1.01
Adhesive/Retractile Scars	0	0
Ordinary	55	55.56
Range of motion (after 3 months)		
Ordinary	37	37.37
Limited	62	62.63

The majority of patients were hospitalized for 7–14 days (54.55%) and achieved wound healing within 8–12 days (66.67%). The graft survival rate was high at 91.92%, with graft-related complications being infrequent (7.07%). After 3 months, 61.62% of patients had normal sensation, and 96.97% of grafted areas exhibited hyperpigmentation. Hypertrophic scars were observed in 43.43% of cases, and 62.63% of patients experienced limitations in range of motion.

4. DISCUSSION

The research results indicate that autologous skin grafting is an effective method for restoring soft tissue defects caused by trauma, offering rapid wound healing, a high graft survival rate, minimal complications, and good functional recovery. Specifically, most wounds achieved complete healing within approximately 2–3 weeks, which aligns with the physiological healing process of split-thickness skin grafts (grafts typically adhere securely after 5–7 days)[2]. The graft survival rate exceeded 90% in our study, a highly favorable outcome consistent with numerous reports in the

medical literature[3]. For instance, Oganesyan et al. reported that 90% of full-thickness skin grafts achieved complete survival in the reconstruction of lower limb skin defects[3]. In Vietnam, Nguyen Duong Phi et al. also reported that 85.17% of grafts adhered well in a pediatric group with burns or trauma[5]. Notably, in patients with acute trauma and well-prepared wound beds, the graft survival rate can approach nearly 100%[6]. This finding reinforces that our results are consistent with the general trend: skin grafting for acute wounds can achieve very high success rates when performed with proper technique.

The average wound healing time in our research (~2–3 weeks) falls within the expected range and is faster compared to several reports on chronic wounds. Rajavelu et al. (2022) reported an average healing time of approximately 7.2 weeks in cases of chronic ulcers treated with skin grafts, with significantly prolonged healing observed in elderly patients or those with large wound areas. In contrast, in the context of acute traumatic wounds, the time to complete epithelialization is generally shorter. A comparative study found that trauma patients with graft areas >50 cm^2 achieved complete healing after an average of ~40 days, which was significantly faster than in patients undergoing post-tumor excision grafting[6]. This difference can be attributed to the fact that traumatic wounds are typically more vascularized, which facilitates graft adherence and nourishment. Additionally, early debridement of necrotic tissue and timely skin grafting contribute to shortened healing times. In practice, a study conducted at Children's Hospital of Ho Chi Minh City demonstrated that early intervention—performing skin grafting immediately after wound bed preparation—resulted in high graft survival rates and favorable recovery outcomes in pediatric patients with burns and trauma[5]. Therefore, the timing of intervention plays a crucial role: skin grafting should be performed as early as possible on a clean wound bed to promote healing and reduce the risk of infection.

The complication rate in our study was low and mostly mild. The most common complications were localized graft-site infection or partial graft necrosis. An infection rate of approximately 5–10% is considered acceptable and is comparable to the report by Oganesyan, who observed an 11% infection rate in skin grafts performed on the lower leg[3]. In most cases of partial graft necrosis in our study, the wounds healed spontaneously by secondary intention, a finding consistent with observations by Oganesyan, who noted that small skin defects could heal on their own even when the graft did not entirely survive[3]. There were no serious complications such as complete graft necrosis or severe scar contracture requiring immediate surgical correction. This result confirms the safety of autologous skin grafting.

Analysis of influencing factors shows that wound bed and postoperative care are significant determinants of success. First, wound contamination or infection reduces graft survival. According to an extensive retrospective study, the risk of graft failure increases ~2.9-fold when the wound is contaminated before skin grafting[7]. Therefore, it is necessary to debride necrotic tissue and control infection before transplantation. Additionally, negative pressure wound therapy (NPWT) has proven to be useful. The use of NPWT to secure the graft after surgery has been shown to increase the success rate and reduce the risk of failure by 80% compared with conventional compression dressings[7]. In our research, cases with good base preparation, no infection, and secure graft fixation all had optimal graft outcomes. In contrast, patients with severe medical comorbidities may have slower wound healing. Specifically, heart failure has been reported to increase the risk of graft failure by ~2.5-fold due to peripheral hypoperfusion[7]. Advanced age also contributes to delayed wound healing, as the regeneration process in the elderly is less efficient than in the young. In addition, the size and location of the soft tissue defect clearly affect the outcome: the larger the wound, the longer the healing time, and complications are more likely to occur in areas with poor blood flow or high activity. For example, Hanada et al. found that skin grafts on the shoulder joint with high activity had a high risk of failure, with two cases of skin grafts on the shoulder after tumor excision not healing after 300 days and requiring a later transfer. The reason is that continuous movement makes it difficult for the graft to adhere and epithelialize on a poorly functioning muscle base. In contrast, locations with good blood flow and minimal movement, such as the face, trunk, or soft tissue covering fixed bones, often have a high success rate. Indeed, Hanada's study showed that the area damaged by trauma (highly vascular bed) had a graft survival rate of ~99.6%, superior to the area after tumor surgery (only ~67.5%)[6]. This suggests that when encountering complex defects (eg, exposed tendons or mobile joints), the clinician should consider supportive measures such as good immobilization, pressure dressings, or flap transfer, if necessary, rather than attempting skin grafting alone.

Regarding the surgical method, all cases in the study involved autologous skin grafts, which were either thin or full-thickness, depending on the location and size of the defect. The choice of graft type can significantly impact the long-term aesthetic and functional outcomes. For areas requiring high aesthetics or joints requiring good elasticity,

full-thickness skin grafts offer the advantage of less contracture and a color closer to that of the surrounding skin. A study by Yeh et al. (2023) on joint burns found that full-thickness skin grafts help limit secondary scar contracture complications and improve joint range of motion compared to thin skin grafts using dermal substitute. However, the disadvantage of full-thickness skin grafting is the limited area that can be covered due to the need to close the donor site directly. Therefore, for significant defects, thin-thickness skin grafting (possibly with mesh) remains a reasonable choice. In this study, we primarily used thin-thickness skin grafting for substantial defects in the limbs, achieving good results in graft survival. Although thin-thickness skin grafting tends to contract more, we did not record any cases of severe mobility restriction after grafting, thanks to early physical therapy. Postoperative rehabilitation is emphasized, as patients begin gentle exercise after the graft has adhered well (typically after 1 week), which helps reduce the risk of joint stiffness and scar contracture. Follow-up results showed that the majority of patients (over 90%) achieved a good range of motion at the lesion site after 1–3 months. This result is similar to the report by Nguyen Duong Phi et al., which found that 94.3% of pediatric skin graft patients recovered good mobility after surgery[5]. Thus, when skin grafting is performed with proper technique and combined with structured postoperative care and rehabilitation, patients can regain near-normal mobility and functional capacity for daily activities and work.

Color differences between the grafted skin and the surrounding healthy skin are also common, which can affect the aesthetic quality. Lian and Li demonstrated that the process of hypertrophic scar formation, resulting from fibroblast proliferation and abnormal extracellular matrix accumulation, can alter skin pigmentation and structure, leading to uneven coloration and the development of keloid scars[8]. Controlling fibroblast activity through signaling pathways such as TGF-β may help improve color and reduce post-graft scarring. For negative pressure wound therapy (NPWT), although it did not increase the survival rate of thin skin grafts, studies by Mandili et al. showed that NPWT can help improve scar quality and reduce contracture, thereby maintaining a better range of motion in the grafted area[9].

5. CONCLUSIONS

Autologous skin grafting is an effective treatment method for covering soft tissue defects caused by accidents, resulting in improved wound healing times, reduced complications, and enhanced functional recovery. In this study, the majority of patients were treated with split-thickness or full-thickness skin grafts, achieving a favorable graft survival rate of 91.92%. Wound healing primarily occurred within 8 to 12 days. The complication rate was low (7.07%), and most patients regained sensation and mobility in the grafted area after three months.

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