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Research Article

Pedicled groin flap in the treatment of complex hand injuries

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ABSTRACT

Aim: Hand injuries can present complicated challenges and require specific treatments for individual tissue defects. This study aimed to describe the outcomes and dependability of pedicled groin flaps in repairing complex hand injuries.

Method: This retrospective study which was conducted between December 2022 and July 2024, included 16 patients with various hand injuries who received pedicled groin flaps for the treatment of hand injuries and who had a suitable recipient vessel for microsurgery, and were older than 18 years of age. Patient demographics, injury aetiologies, flap details, and postoperative outcomes were reported. Mean follow-up period was 6 months.

Results: The mean age was 39.5 years, and 81.25% of them were male. Trauma, burns, and tumors were among the underlying causes. All subjects, maintained flap survival and full covering of the soft tissue. A mean flap size of 6.06 cm x 4.81 cm was reported. There was only one patient who experienced partial flap necrosis, which healed secondarily. In 37.5% of patients, donor site closure was accomplished by primary closure; in other patients, partial-thickness skin grafting was necessary.

Conclusion: This study suggests that the pedicled groin flap is still a superior therapy for complex hand injuries and remains a practical choice especially for facilities without access to microsurgical technology or experience. Despite certain drawbacks, the groin flap is a useful technique in upper extremity reconstruction due to its simplicity of harvesting, low donor site morbidity, and capacity to give appropriate soft tissue coverage.

Keywords: complicated tissue defects, hand injury, groin flap

Introduction

Hand injuries can be complex due to differences in the dorsal and volar compartments, configuration of the fingers and, tendon, nerve, bone, and soft tissue injuries; making the treatment also specific (1,2). Partial or complete skin grafts, acellular dermal matrices, pedicled, perforator, local and free flaps are among the alternatives for the repair of such tissue defects. However, the safety and superiority of one treatment over the other is controversial; because in hand injuries, the size and site of the injury, the timing of debridement, the patient's negative factors related to wound healing, other accompanying injuries, vascular problems that reduce flap options are crucial in the selection of the treatment (3,4).

For many surgeons, covering the upper extremities' soft tissues still presents an issue. Stable covering, an appealing appear,

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and functional repair are the primary goals of restoration. Large, complicated hand deformities were long treated with pedicled flaps from the groin or abdomen. The groin flap, first described by McGregor and Jackson in the 1970s, gained popularity as a method for covering complicated soft tissues in the hand (5).

The flap chosen in this study was a pedicled groin flap which is a cutaneous flap with an axial structure that relies on the superficial circumflex iliac arteriovenous system (6). It is possible for every region of the hand as well as the distal two thirds of the forearm to receive soft-tissue coverage by groin flap. Despite bearing some challenges for both the surgeon and the patient, the pedicled groin flap is simpler, faster, easier to perform and has a more rapid learning curve for the surgeon compared to the microsurgical option (7). Therefore, we suggested that pedicled groin flap remains as a favorable option for complicated hand defects. The purpose of this study was to assess the outcomes of pedicled groin flap on the treatment of complex hand injuries.

Materials and Methods

Patient selection and study design

This descriptive retrospective study was conducted between December 2022 and July 2024 and included 16 patients who underwent pedicled groin flap reconstruction for complex hand injuries. Patients were selected based on following criteria: (1) presence of a soft tissue defect in the hand requiring flap coverage, (2) availability of a suitable recipient vessel for microsurgery (to standardize patient selection), (3) age over 18 years, and (4) adequate medical records with documented postoperative follow-up. Exclusion criteria included: (1) patients with vascular conditions affecting flap viability, (2) those with extensive comorbidities impairing wound healing (e.g., diabetes with severe complications), and (3) those lost to follow-up before outcome assessment.

The study protocol was approved by Ethical committee of Başakşehir Çam and Sakura City Hospital Scientific Research No.1 Ethics Committee, Date: 12.03.2025, Number 79.

Age, gender, type of injury, location of the defect, flap separation time, delay requirement, donor site closure, and complications were examined. Postoperative complications were classified as major or minor based on their impact on flap viability, the need for surgical intervention, and their effect on functional recovery. Major complications included flap-related issues such as partial or total flap necrosis requiring secondary surgical procedures or revision, donor site complications like significant infection, dehiscence, or hematoma requiring intervention beyond routine wound care, and severe joint stiffness affecting elbow or shoulder mobility that necessitated prolonged rehabilitation. Minor complications included wound healing issues such as delayed healing, localized infection, or mild seroma/hematoma that resolved with conservative management, donor site concerns like mild color mismatch or contour irregularities that did not require surgical correction, and mild joint stiffness that improved with physical therapy. All complications were recorded during postoperative follow-ups at one week, one month, three months, and six months, and were classified accordingly.

Pedicled groin flap reconstruction

One third of the flap was designed above the inguinal ligament and two thirds below. Flap dissection was started at the lateral border without including the fascia (Figure 1). Ischemic conditioning was performed for 3 minutes with a tourniquet method between postoperative days 10-14, and surgical delay was initiated in patients who completed 15 minutes without pain. All patients were mobilized as early as possible. The axillary region was powdered, arm and forearm fixation were performed with the help of soft elastics in the peroperative period. Patients were washed weekly. Dressings and flap follow-up were performed daily.

Fig. 1. Insertion of flap into a wrist tissue defect with wide tendon and nerve exposure.

Follow-up duration

The mean follow-up period was 6 months (range: 4–8 months). Postoperative assessments were conducted at 1 week, 1 month, 3 months, and 6 months to evaluate flap survival, complications, and functional recovery. Patients requiring additional procedures, such as debulking, were followed up accordingly.

Statistical analysis

No statistical analysis was performed in this study as it is a retrospective descriptive study without a control group or comparative cohort. The data presented are summarized using descriptive statistics (e.g., mean, range, and percentage) to report patient demographics, injury characteristics, flap details, and postoperative outcomes. Since this study does not test a specific hypothesis or compare different interventions, no power analysis was conducted.

Results

The mean age of patients was 39.5 (25-56) years with 13 (81.25%) of the cases being male. The aetiologies of hand injuries included trauma (43.75%), burn and tumor. The indications for this procedure were as follows: complicated injuries of the dorsal hand, crush injuries, tissue defects with bone tendon exposure, large full-thickness tissue defects of the wrist and volar face, multiple finger or hand degloving injuries (Table 1).

Table 1. Patient demographics, injury and flap details, postoperative outcomes

Patient no.	Age	Gender	Aetiology	Defect location	Flap Size (cmxcm)	Flap Separation Time	Donor Closure	Flap Necrosis
1	25	Male	Trauma	Wrist dorsal	7x6	22	Graft	None
2	35	Male	Burn	Hand dorsum	8x5	25	Graft	None
3	39	Male	Burn	2-3-4th fingers volar face	5x3	27	Primer	None
4	52	Male	Burn	Wrist volar	5x4	24	Primer	None
5	43	Male	Trauma	Hand dorsum	4x4	18	Primer	Partial
6	33	Male	Trauma	Forearm volar	8x6	20	Graft	None
7	56	Male	Trauma	4th finger circular	4x3	23	Primer	None
8	42	Male	Burn	Wrist volar	7x7	21	Graft	None
9	39	Male	Tumor	Forearm volar	9x6	21	Graft	None
10	38	Female	Burn	Hand palmar surface	5x5	19	Graft	None
11	24	Male	Trauma	4-5th Fingers volar	4x3	28	Primer	None
12	45	Male	Burn	Dorsal wrist	8x7	26	Graft	None
13	35	Female	Burn	Wrist volar	5x5	21	Graft	None
14	35	Male	Trauma	Hand dorsum	6x4	20	Graft	None
15	46	Female	Burn	Hand dorsum	9x6	18	Graft	None
16	45	Male	Trauma	4th finger circular	3x3	20	Primer	None

The mean flap size was calculated as 6.06 x 4.81 cm^2. According to the size of the flap, the donor sites were closed with primary closure in only 6 (37.5%) patients, while partial-thickness skin grafting was required in the other subjects. All flaps were fully detached at 1 month. Complete soft tissue coverage and flap survival were achieved in all patients. Patients started physical therapy in the early postoperative period and functional success was achieved.

The timing of flap separation varied among patients, ranging from 18 to 28 days postoperatively. This variability was influenced by several factors, including the flap size and thickness, extent of recipient site vascularization, postoperative flap monitoring, surgeon preference and institutional protocols. All flaps were completely detached within one month, and no cases required additional delay beyond this timeframe.

Among the major complications, only 1 patient (6.25%) developed partial necrosis distal to the flap. The necrosis area was allowed for secondary healing (Table 1). No cases of total necrosis or complete flap failure were observed. In terms of minor complications, 3 patients (18.75%) required debulking at 6 months postoperatively, with satisfactory cosmetic outcomes. Six patients (37.5%) complained of color difference in the visible part of the hand, and camouflage with micro skin make-up was recommended. No significant donor site morbidity requiring surgical intervention was recorded. Some patients experienced transient elbow or shoulder stiffness, which resolved with early mobilization and physical therapy.

Discussion

Groin flap is an axial flap elaborated over the Arteria iliaca circumflex superficialis pedicle. It was first described by McGregor and Jackson in 1972 (6). Its elevation as a free flap over the same pedicle was realized in the following few years (8). Groin flap is the flap of choice for complicated hand and upper extremity wounds (9). Upper extremity injuries are usually characterized not only by loss of skin and subcutaneous tissue but also by tendon, nerve and bone injuries which are very likely to occur in this area during trauma since the skin and subcutaneous supportive tissue is thin (10). The aim of this study was to investigate effectiveness of pedicled groin flap on complex hand injuries with defected tissues. Our study showed that all patients who underwent treatment with the pedicled groin flap had full soft tissue coverage and flap survival, displaying favorable outcomes in terms of flap necrosis with the exception of one patient who experienced partial necrosis distal to the flap.

Drawbacks of utilizing groin flap include the fact that it requires 2 sessions, the vascular supply of the pedicle requires delay, the flap is often a thick mass and needs to be thinned, and patients are often left in the same posture during this time, often resulting in shoulder joint stiffness (7). However, the pedicled groin flap is still suggested to remain a favorable option for the repair of complicated hand injuries, as it bears multiple crucial advantages. The major advantage of groin flap is that the donor site morbidity is low and the tissue obtained is sufficient to cover the soft cast. The donor site can be closed primarily depending on the size of the defect, and the use of partial-thickness grafts in patients with incomplete closure is neither cosmetically nor functionally problematic (11).

When considering reconstructive options for soft tissue defects, particularly in the groin area, the choice between groin flaps and free flaps is pivotal in optimizing patient outcomes. Groin flaps, primarily pedicled flaps that utilize local tissue, present several advantages over free flaps, particularly regarding ease of use and reduced complication rates. On the other hand, free flaps offer versatility and can cover larger, and albeit with increased technical demands and longer operative times (12-14).

In contrast, free flaps, such as the anterolateral thigh (ALT) flap, allow for more significant

tissue transfer over longer distances. This capability is critical in reconstructing larger defects or those located far from the donor site. Studies have shown that free flaps have become the gold standard for complex reconstructions, providing not only sufficient coverage but also the opportunity to incorporate multiple tissue types, such as muscle and skin, in a single procedure (11,13). However, they require advanced surgical skills and can lead to complications like reconnective vessel thrombosis or flap failure, necessitating attentive postoperative management (15).

Technically, flap elevation is easy to perform. After marking the pedicle with hand doppler and making proper drawings, it requires a short time to fully elevate the flap (16). In cases where the defect includes bone, the ability to lift it as a composite tissue is among its advantages (12). It can also be easily designed in various shapes such as skin island bilobe (17). In addition to lifting and insetting the flap, fixation and immobilization of the patient's extremity in the appropriate position is just as important (14). Especially during the recovery of the patient from anesthesia, the unconscious desire to move the flap may separate the flap from the inset and disrupt its circulation. For this reason, it is recommended that the drawings should first be performed standing up and the other arm should be taken as a basis to calculate which groin flap will be more comfortable in terms of elbow and shoulder, and the patient should be consulted. When obtaining written consent from the patient in the preop period, the patient should be told not to remove his/her hand when waking up from anesthesia. Another precaution is to fix the entire upper extremity with elastic bandages, partial casts or sutures after the flap is inset. This rigid fixation is necessary for the patient's adaptation phase. Some publications have even reported the use of external fixators (18).

According to our findings, the pedicled groin flap completely covered the soft tissue and survived in each case. These findings are consistent with the results of earlier researches that have demonstrated the pedicled flap's efficacy in treating complicated hand injuries (19). The flap's effectiveness in obtaining both coverage and hand function restoration is highlighted by the fast recovery seen in patients as well as their positive functional outcomes.

The timing of flap separation remains a critical step in pedicled flap procedures, and in our study, this varied between 18 and 28 days. Factors contributing to this variability included flap dimensions, recipient site vascularization, and postoperative circulatory adaptation. Our findings align with previous literature, where separation times typically range between 2.5 to 4 weeks, depending on similar patient and procedural factors (6,10). A more standardized approach to determining separation time in future studies may help optimize outcomes and minimize complications.

Despite the positive outcomes observed, this study has several limitations. First, as a retrospective study, it is inherently subject to selection bias. Patients were not randomized, and the decision to use a pedicled groin flap was based on the surgeon's preference, institutional experience, and the availability of microsurgical expertise. Second, the follow-up period was limited to a mean of 6 months (range: 4–8 months), which may not capture potential long-term complications such as late contracture formation or functional impairment. Longer follow-up studies would be necessary to assess the durability of the reconstruction and long-term patient satisfaction. Third, this study lacks a control group that underwent alternative reconstructive techniques, which would have provided a more direct comparison of outcomes. A prospective study with a comparative cohort, including local and free flaps, could yield more robust conclusions.

Conclusion

In today's plastic and reconstructive surgery modality, free tissue transplants maintain their priority and essentiality. However, it is

not possible to be applied in every patient. Especially in trauma areas with large defects, regional full-thickness burns and after some tumor surgery, recipient vascular problems may occur. Furthermore, not all medical centers have microsurgery experience or equipment, making it difficult to perform. Groin flap stands out due to the ease of anatomy, simplicity of surgical experience compared to other free tissue transplantation surgeries, low donor site morbidity, and the ability to provide sufficient soft tissue. Especially in areas such as the upper extremities, where functionality must be preserved, the ability to compose with bone and asia also offers its advantages. The design of a tubular pedicle protects the vessels and at the same time facilitates postoperative delay. In this framework, we conclude that the groin flap is still a superior alternative in upper extremity defects. Future comparative prospective studies with larger sample sizes and longer follow-ups are needed to further assess the long-term functional and aesthetic outcomes of different reconstructive options.

Ethical approval

The study protocol was approved by Ethical committee of Basaksehir Cam and Sakura City Hospital Scientific Research No.1 Ethics Committee, Date: 12.03.2025, Number 79.

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: PK; data collection: AS; analysis and interpretation of results: AS; draft manuscript preparation: PK, AS. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of interest

The authors declare that there is no conflict of interest.

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