

## Complications in Hands' Dorsum Reconstruction via Groin Flap: A Prospective Study

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### Abstract

**Introduction:** The utilisation of the groin flap has been a longstanding practise in the field of reconstructive surgery for over four decades. Hand injuries are a prevalent phenomenon that necessitates effective management in order to optimise workforce productivity and alleviate the economic strain on a nation. The objective of this study was to investigate the efficacy of utilising a groin flap for the purpose of wound coverage on the dorsum of the hand. Objective: The objective of this study was to assess the efficacy of the "Groin Flap" technique for the reconstruction of defects on the dorsum of the hand in paediatric patients.

**Methods:** This prospective study was carried out at the Department of Plastic Surgery, Patna Medical College Hospital, Patna, India. A cohort of 25 subjects were selected for the research investigation, employing a systematic sampling approach during the designated study duration. The subjects included patients who were admitted subsequent to experiencing electric burn injuries resulting in hand deformities, and subsequently underwent treatment involving the utilisation of pedicled groin flaps.

**Results:** All paediatric patients who underwent pedicled groin flap surgery demonstrated normal functional outcomes, indicating successful treatment. Moreover, these patients exhibited the ability to independently engage in activities essential for their daily lives. All of the paediatric patients exhibited a favourable aesthetic outcome.

**Conclusion:** The utilisation of the groin flap technique has been determined to be a valuable approach for the preservation and restoration of hand functionality. This method has consistently yielded favourable outcomes, both in terms of functional capabilities and aesthetic appearance, across various cases.

**Keywords:** Hand injury, hand trauma, groin flap, children.

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### Introduction

Electrical injuries in paediatric patients, although less prevalent compared to the adult population, constitute approximately 3-10% of all admissions for burn injuries on a global scale [1, 2, 3]. The primary aetiologies of low voltage injury in paediatric patients include the act of inserting foreign objects into electrical outlets, engaging in cord biting behaviour, coming into contact with household wires, or encountering malfunctioning appliances [4, 5]. High voltage electrical injuries have been attributed to inadvertent contact with power lines in the adolescent population or as a result of being struck by lightning [6]. According to existing literature [7], they represent the primary aetiology for amputation cases observed within burn care facilities.

The upper extremity plays a vital role in the human body as it supports and maintains the functionality of the hand, which is considered the second most perceptive organ after the brain. The soft tissue envelope of the hand exhibits a distinctive

anatomical structure that facilitates the reception of tactile stimuli from the surrounding environment, while also enduring significant mechanical stress throughout an individual's lifespan [8].

The majority of hand surgeons encounter the formidable task of hand reconstruction, which involves addressing the nature and magnitude of tissue loss in order to restore optimal hand functionality. This is achieved through the utilisation of various reconstructive techniques, including skin grafts, local flaps, regional flaps, distant flaps, and free flaps [9]. Skin grafts may not always yield the most favourable functional or aesthetic outcome. The application of a dermal graft over the paratenon or periosteum has the potential to result in an unstable scar formation. Additionally, it should be noted that skin grafting procedures often do not result in the restoration of sensory function, which is a crucial aspect for optimal hand functionality [10]. All flaps encompass the complete depth of the integumentary system, including the

skin and subcutaneous tissue, and are accompanied by their own vascular network. Consequently, they offer superior and long-lasting dermal coverage, while also affording sensory function due to their inherent innervation by cutaneous nerves [11]. The objective of this study was to assess the outcome of paediatric electric hand burn injuries treated with pedicled groin flap and its efficacy in the current era characterised by the growing utilisation of free flaps.

### Methods

This prospective study was conducted at the Department of Plastic Surgery, Patna Medical College Hospital, Patna, India, with the aim of investigating and analysing relevant medical data in an academic setting. A cohort of 25 subjects was selected for the research investigation, employing a systematic sampling approach during the designated study duration. The subjects included patients who were admitted subsequent to experiencing an electric burn injury resulting in hand deformity, and who subsequently underwent treatment involving the utilisation of a pedicled groin flap.

**Inclusion criteria:** Patients admitted for electric burn injury, patients who gave consent were included.

**Exclusion criteria:** Patients having associated head injury and concomitant injury to groin region and who did not give consent were excluded.

**Data Collection:** Details related to gender, age, type of voltage injury, site of injury, investigations, operative procedures and photographs were recorded.

**Statistical Analysis:** All data documented in a pre-established medical case report form and meticulously assessed for any discrepancies. The data was analysed utilising the software SPSS (Statistical Package for Social Sciences).

### Results

The pedicled groin flap procedure was performed on a cohort of 25 paediatric patients, ranging in age from 5 to 12 years (mean age = 9), who had sustained electric contact burns. Among these patients, 21 (84%) were male and 4 (16%) were female. Table 1 presents the patient distribution based on the classification of voltage-related injuries. Five patients were observed to exhibit low voltage (1000 volts) as a result of exposure to high voltage power lines. Table 1 additionally demonstrates the diverse regions of hand engagement observed in the subjects. In this research investigation, a total of 10 individuals exhibited injury to the dorsum of the hand, while eight individuals presented with injury to the wrist. The right hand exhibited a higher prevalence of involvement. Minor injuries in other regions were treated using a conservative approach involving the application of silver sulfadiazine dressings. In this study, the researchers utilised a flap of up to 12 cm in length for the purpose of resurfacing a hand defect. Conversely, the minimum flap length employed was 5 cm, specifically for the coverage of a degloved thumb. Although the occurrence of complete flap necrosis was not observed in any of the cases included in the study, partial flap necrosis was documented in two patients. Two patients exhibited donor site dehiscence.

**Table 1: Case distribution according to mode, area, postoperative complication of injury**

<b>Voltage</b>	<b>Frequency</b>	<b>Percentage</b>
Low	20	80%
High	5	20%
<b>Area involved</b>	<b>Frequency</b>	<b>Percentage</b>
Dorsum of hand	10	40%
Palm surface	2	8%
Fingers	1	4%
Thumb	4	16%
Wrist	8	32%
<b>Complication</b>	<b>Frequency</b>	<b>Percentage</b>
Complete flap necrosis	-	-
Partial flap necrosis	02	08%
Donor site dehiscence	02	08%
Recipient site infection	02	08%

Two additional patients presented with seropurulent discharge from the recipient site, which was treated using conservative measures. Fortunately, this did not lead to any negative consequences, except for delayed detachment and subsequent establishment in these particular individuals (refer to Table 1). The

sole complaint reported by the patient was of pain, which was effectively managed through the administration of basic analgesic medications. The issue of increased bulkiness of the flap at the recipient site was encountered in five instances, necessitating thinning of the flap following

detachment, typically performed in one or two sessions. The functional outcome of all patients evaluated during the follow-up period demonstrated satisfactory results in terms of their ability to utilise their hand for activities such as eating, drinking, writing, and dressing. During the follow-up visit, the aesthetic outcome was deemed satisfactory by all parents of the children.

### Discussion

The inguinal flap is a well-established and dependable technique that has been utilised for the reconstruction of soft tissue deficiencies. Due to the consistent anatomical landmarks and a well-established axial blood supply, the procurement of a groin flap is a straightforward procedure [9]. In individuals presenting with electric burn injuries to the hand, the utilisation of a groin flap for wound coverage represents a highly favourable option. This is primarily attributed to the advantageous preservation of the donor site, which remains relatively unaffected and exhibits a satisfactory state of health in these particular patients. Furthermore, the utilisation of free flaps may not be a favourable choice in patients of this nature, as the affected region may lack suitable recipient vessels for the purpose of anastomosis in cases of acute burns to the hand [10]. The observed male predominance documented in the study aligns with findings from previous investigations on paediatric burn injuries [10, 11]. The majority of cases observed were attributed to low voltage injury, suggesting that a significant number of children experienced electric injuries within their residential settings, likely resulting from the utilisation of indoor appliances and electrical wiring. It is imperative to establish a safer and more attentive environment for children within their homes in order to mitigate the occurrence of such incidents [3] (Table 1). Similar findings were observed by other researchers [2, 12]. In their comprehensive investigation, Wallace BH et al. determined that a significant proportion of paediatric electric burns were attributed to low voltage household electric appliances, particularly in the younger patient population [5]. Comparable findings were observed in the investigation conducted by Katherine LT et al., wherein the average age of the participants was 7.6 years and 30% of the patients necessitated surgical intervention [13]. Similarly, in the study conducted by Lui P et al., it was found that 61% of children with burn injuries underwent surgical management. The researchers concluded that electric burns impose substantial morbidity on paediatric patients [11].

In this research investigation, the utilisation of the groin flap technique was employed as a reconstructive method for managing challenging paediatric cases afflicted with electric contact burns of the hand. The primary obstacle encountered was

the preservation of limb position in paediatric patients until the point of detachment, necessitating the provision of a comprehensive rationale for the significance of limb positioning in flap attachment. Additionally, it was imperative to offer reassurance to the family members in order to foster cooperation (Table 1). Elastic adhesive bandages were employed to secure the extremity in a fixed anatomical alignment. Infection and flap necrosis are commonly recognised complications observed in the context of groin flap procedures. In this research investigation, the presence of seropurulent discharge was observed in two instances, both of which were effectively treated through the implementation of standard wound dressing techniques and administration of appropriate antibiotic therapy. There was no evidence of complete flap necrosis observed in any patient, although partial necrosis did occur in two cases. In these instances, prompt debridement and advancement of the flap were performed. The donor site was primarily closed in all cases, necessitating flexion at the hip and knee joint in four patients. Two patients experienced donor site dehiscence, which was addressed through secondary closure during the detachment and inset of the flap. The findings of our investigation demonstrate similarity to previous studies conducted by researchers regarding the utilisation of groin flap for the purpose of closing hand defects in adult individuals. However, it is worth noting that there is a limited availability of reports pertaining to the application of this technique in the paediatric population [12, 13, 14]. Extensive electrical burns have the potential to induce a broad area of tissue damage, thereby compromising the reliability of local flaps for surgical reconstruction. The feasibility of free tissue transfer may be compromised in cases where a medically compromised patient is unable to withstand a prolonged surgical procedure, or when there is a lack of access to the necessary microsurgical expertise or equipment [15, 16]. In such clinical scenarios, the utilisation of pedicled flaps originating from unaffected distant tissue presents a viable alternative approach for achieving soft tissue coverage in the hand.

### Conclusion

The utilisation of a groin flap is a highly advantageous alternative within the armamentarium of plastic surgeons, particularly in cases where there is uncertainty regarding the vascularity of the donor site for a free flap procedure. Despite an extended duration of hospitalisation, the patient's prolonged discomfort due to positioning, and multiple surgical interventions, the outcomes achieved through the implementation of the groin flap technique are both reliable and gratifying. The utilisation of the pedicled groin flap is therefore considered a reliable and efficient approach for the preservation and

restoration of hand functionality in paediatric patients.

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