ISSN 2473-4799

DERMATOLOGY
OpenJournal

Openventio
PUBLISHERS

Case Study

Application of Delayed Keystone Flap in Management of Post-Electrical Burn Squamous Cell Carcinoma

Ravi K. Chittoria, MCh, DNB, MNAMS, FRCS (Edin), DSc, PhD*; Marenika Manisekaran, MBBS, MS; Jacob A. Chakiath, MBBS, MS

Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry 605006, India

Corresponding author
Ravi K. Chittoria, MCh, DNB, MNAMS, FRCS (Edin), DSc, PhD
Professor, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry 605006, India;
E-mail: drchittoria@yahoo.com

Article information
Received: May 16th, 2022; **Revised:** July 26th, 2022; **Accepted:** August 8th, 2022; **Published:** August 11th, 2022

Cite this article
Chittoria RK, Manisekaran M, Chakiath JA. Application of delayed keystone flap in management of post-electrical burn squamous cell carcinoma. *Dermatol Open J.* 2022; 7(1): 9-11. doi: 10.17140/DRMTOJ-7-149

ABSTRACT

Aim
The aim of the study is the application of delayed Keystone flap in the management of post-electrical burn squamous cell carcinoma.

Materials and Methods
In our study, a delayed staged type 3 keystone flap was performed as first stage procedure.

Result
In our study, by doing a delayed staged type 3 keystone flap we were able to successfully reduce the size of the defect by 40% without necrosis of the inset flap.

Conclusion
Delaying of the flap is a useful method when the vascularity of the keystone flap is doubtful especially in the case of post electrical burn.

Keywords
Delayed keystone flap; Squamous cell carcinoma; Electrical burn.

INTRODUCTION

Squamous cell carcinoma is one of the most common skin malignancies, which may develop in any burn scar, traumatized, chronically inflamed scarred skin or post-radiotherapy scars.[1] The incidence of chronic ulcers transforming into malignancy is 2% to 6%.[2] The Keystone-designed flap is widely used for loco-regional reconstruction for any defect which may be closed primarily. The Keystone flap is one of the local flaps that facilitate the closure of defects primarily without tension. It is simple, with better aesthetic results and stable coverage. Various other flaps have been described for reconstruction, including local, regional, distant, and microvascular flaps.

The delay phenomenon, also called ischemic preconditioning, describes the observation that a tissue rendered partially ischemic will undergo neovascularization and enhance its vascularity.[3]

MATERIALS AND METHODS

The study was carried out in a tertiary care hospital in South India after receiving approval from the departmental ethical committee. The subject was a 32-year-old male patient with a history of an electrical burn 10-years back, following which he developed a non-healing ulcer on the back. On examination, the ulcer was on the back more towards the right of the midline, oval in shape, and the margins were everted (Figure 1). After the initial routine investigat-

Figure 1. *Raw Area of the Back*

ion, the patient underwent a computed tomography (CT) Dorso-Lumbar scan to rule out osteomyelitis. The ulcer on the back was excised and sent for histopathology to rule out any malignant aetiology.

The post-excision defect was 6 cm wide and 10 cm long (Figure 2). Histopathology showed squamous cell carcinoma. In view of squamous cell carcinoma, staging work-up was done and ruled out regional and distant metastasis. Following the closure of the defect, radiotherapy was recommended for the site. As the surrounding tissue was unhealthy (scaring and adhesions due to electrical burn), a delayed staged type 3 keystone flap was performed as a first stage procedure (Figure 3). The future plan (second stage) is to do the remaining delayed staged keystone flap or transposition flap on the opposite side based on the vascularity and clinical judgement.

Figure 2. *Raising of the Flap in Delayed Staged Keystone Flap*

Figure 3. *Delaying of the Keystone Flap by Re-suturing*

RESULTS

In our study, by doing a delayed staged type 3 keystone flap, we were able to successfully reduce the size of the defect by 40% without necrosis of the inset flap (Figure 4).

Our plan is to deal with the remaining defect with a delayed staged keystone flap or transposition flap based on the vascularity and clinical judgement.

Figure 4. *Inset of the Delayed Staged Keystone Flap (Arrow)*

DISCUSSION

The Keystone flap is one of the local flaps that facilitate the closure of defects primarily without tension. It is usually a curvilinear shaped, trapezoidal designed flap. It is essentially two V-Y flaps, end to side. It is initially described and classified by Behan.[4] It is called the "keystone flap" because the design of this flap is similar to the keystone used to support the arch in Roman constructions. For designing a keystone flap, the excision should be parallel to the vessels or the line of perforators in that region. The flap is based on these fasciocutaneous perforators. There are four types of keystone flaps described.[5]

Type 1: Standard flap design, without cutting the deep fascia (suitable for defects up to 2 cm wide)
Type 2: Standard flap design with deep fascia cut along the flap margins
Type 2A: Flap inset closes the defect primarily
Type 2B: Secondary defect created which is covered using split thickness skin graft
Type 3: Double keystone flaps, designed on either side of the defect
Type 4: Rotational keystone flap

In our study, we decided to choose Type 3 delayed keystone flaps. Pelissier et al[6] have described it as universally applicable and extremely reliable for defects from head to toe. Various modifications of the keystone design flap are described in the literature. From head to toe, keystone flap has been used to repair defects in the trunk, perineum, vulva, thigh, leg, dorsum of foot, sole, arm, forearm, dorsum of hand, cervico-submental region, eyelid, root of nose, face, and parotid region. It has been used for various defects like post-trauma, post-tumor excision, post-meningomyelocele excision, etc.[7]

CONCLUSION

Delaying of the flap is a useful method when the vascularity of the keystone flap is doubtful, especially in the case of a post-electrical burn.

CONSENT

The authors have received written informed consent from the

patient.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

1. Kopp J, Loos B, Spilker G, Horch RE. Correlation between serum creatinine kinase levels and extent of muscle damage in electrical burns. *Burns*. 2004; 30: 680-683. doi: 10.1016/j.burns.2004.05.008

2. Turegun M, Nisanci M, Guler M. Burn scar carcinoma with longer lag period arising in previously grafted area. *Burns*. 1997; 23: 496-497. doi: 10.1016/s0305-4179(97)00041-7

3. Stekelenburg CM, Marck RE, Tuinebreijer WE, de Vet HC, Ogawa R, van Zuijlen PP. A systematic review on burn scar contracture treatment: Searching for evidence. *J Burn Care Res.* 2015; 36: e153-e161. doi: 10.1097/BCR.0000000000000106

4. Behan FC. The keystone design perforator island flap in reconstructive surgery. *ANZ J Surg*. 2003; 73: 112-120. doi: 10.1046/j.1445-2197.2003.02638.x

5. Mohan AT, Rammos CK, Akhavan AA, et al. Evolving concepts of keystone perforator island flaps (KPIF): Principles of perforator anatomy, design modifications, and extended clinical applications. *Plast Reconstr Surg*. 2016; 137: 1909-1920. doi: 10.1097/PRS.0000000000002228

6. Pelissier P, Santoul M, Pinsolle V, Casoli V, Behan F. The keystone design perforator island flap. Part I: Anatomic study. *J Plast Reconstr Aesthet Surg*. 2007; 60: 883-887. doi: 10.1016/j.bjps.2007.01.072

7. Pelissier P, Gardet H, Pinsolle V, Santoul M, Behan FC. The keystone design perforator island flap. Part II: Clinical applications. *J Plast Reconstr Aesthet Surg*. 2007; 60: 888-891. doi: 10.1016/j.bjps.2007.03.023