

Role of Keystone Flap in Finger Reconstruction

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Abstract

Finger defects carry high risk of wound dehiscence and necrosis if closed primarily. Various flaps have been described for finger reconstruction. Keystone design perforator based island flap (KDPIF) is a viable option of local flap for a medium size defect of finger. KDPIF is essentially two V-Y advancement flaps moved in end to side fashion. Here we present a case report of use of type-1 KDPIF for the reconstruction of post excision defect of index finger.

Keywords: *Keystone flap; Finger; Reconstruction*

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Introduction

Finger having limited surrounding tissue, it is difficult to close the defect primarily. If an attempt is made to close the defect under tension then risk of wound dehiscence and necrosis is high. Various flaps have been described for finger reconstruction including local, regional, and distant and microvascular flaps. One of the essential requirements is to provide sensate flap. Local flaps have advantage of carrying sensations and hence are commonly used for covering finger defects. Commonly used local flaps include V-Y flap, local transposition flap etc. Keystone flap is one of the local flaps which facilitate the closure of defect primarily without tension [1]. On literature search authors did not find application of keystone flap in finger reconstruction and hence reporting this case with review of literature.

Case Report

This study was conducted in the department of plastic surgery in a tertiary care hospital in March 2019. An informed written consent was obtained from the subject under study. The subject was a 36 year old lady, presented with a history of painless, slow growing swelling on the left index finger since 2 months. On examination there was a lesion of 5 mm size, which was non tender, erythematous, pustular lesion on the radial aspect of left index finger between middle and distal finger crease, just volar to the midaxial line (Figure1). The clinical provisional diagnosis was pyogenic granuloma. The plan was to excise & reconstruct the defect with a cover by keystone type-1 flap (Figure 2). The reconstruction was done under local anesthesia with digital tourniquet. The lesion was excised and sent for histopathological examination. Post excision defect was 10 mm wide

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and 15 mm long (Figure 3). The defect was covered with type-1 keystone flap as planned (Figure 4). Indication of keystone flap for this reconstruction was to avoid closure under tension.

For designing a keystone flap the defect was made in the elliptical shape. On one (dorsal) side of the defect a curve parallel to the side of the ellipse was drawn taking width of the flap same as that of the defect. Then tangents were drawn from both ends of the ellipse and perpendicular lines were made up to the point of intersection with the curve [1]. After marking the flap skin and subcutaneous tissue were cut leaving the fascia intact. Flap was mobilized to cover the defect and two stay sutures were put. V-Y advancement was gained from both ends of the flap. Both ends were closed in Y fashion. Two triangles of excessive tissue at the volar margin of the defect were cut and discarded from the flap. Then the flap inset was given using Hemming technique (horizontal everting mattress method of suturing) [1]. Light moist dressing was put on the flap and finger splint was applied. Hand elevation provided with the arm pouch. Postoperative period was uneventful with no tension on sutures, flap dehiscence or necrosis. Sutures were removed after 2 weeks and silicon sheet applied over scars to facilitate normal scar maturation. Figure 5 shows well settled flap with good scar after follow up period of 6 weeks.



Figure 1: The lesion on radial aspect of Lt Index finger just volar to midaxial line.



Figure 2: Plan for excision and coverage with type-1 keystone design perforator based island flap (KDPIF).



Figure 3: The lesion is excised.



Figure 4: Defect is closed with keystone design perforator-based island flap (KDPIF).



Figure 5: Flap status at 6 weeks follow up. Note the well settled scars.

Discussion

The KDPIF is a curvilinear shaped trapezoidal design flap. It is essentially two V-Y flaps end to side [1]. It was initially described and classified by Behan [1]. It is called keystone flap because design of this flap is similar to 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 [2]. The flap is based on these fasciocutaneous perforators. There are four types of keystone flaps described [1].

Type 1: Standard flap design, without cutting the deep fascia (suitable for defects up to 2 cm wide)

Type 2A: 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

Pelissier et al. [3] have described it as universally applicable and extremely reliable flap for defects from head to toe. There are various modifications of the keystone design flap described in literature [4,5]. KDPIF has been used from head to toe for defects of trunk, perineum, vulva, thigh, leg, dorsum of foot, sole, arm, forearm, dorsum of hand, cervico-submental region, eye lid, root of nose, face and parotid region. It has been used for various defects like post trauma, post tumour excision, post meningomyelocele excision etc. [3-10].

We used keystone design island flap type-1 for reconstruction of defect in the radial aspect of index finger. Finger defects on midaxial lines are expected to face tension when finger is flexed and thus they are prone for wound dehiscence. Blood vessels of finger form a ladder pattern. Digital vessels run in longitudinal fashion along the length of the finger and give multiple transverse branches which are interconnected. Thus finger skin has a rich vascular supply and a keystone flap can be easily planned parallel to the digital vessels. A flap based on dorsal skin is relatively easier to move compared to volar skin. Similar flap can be planned based on volar skin also if required. Upto 2 cm wide defects can be closed with type-1 KDPIF, provided that sufficient lateral skin is available [1]. Postoperative period of our flap was uneventful and it did not show any features of venous congestion or ischemia. Pin cushioning type oedema is a described as an expected complication of KDPIF flaps, but we did not observe that in our case. Keystone flap produces more scarring compared to primary closure. In case of finger reconstruction scar hypersensitivity may be a long term complication of this procedure. Our patient is under follow up for long term outcomes of the procedure. This is a single case report about use of KDPIF for finger reconstruction. This case report shows that use of KDPIF is suitable for reconstruction of finger defects. A large case series is required to study its anatomical and clinical effects. To conclude keystone design perforator based island flap (KDPIF) is another addition to the armamentarium of plastic surgeons for finger reconstruction.

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