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Case Report
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Reconstruction of elbow defect with radial collateral artery perforator flap

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ABSTRACT

Elbow defects form a challanging subgroup to reconstruct among upper extremity defects. We aimed to present a succesful case of elbow defect reconstructed by a Radial Collateral Artery Perforator Flap (RCAPF), also to discuss the advantages and applicability of this flap in light of current literature.

Key words: *Elbow defects, perforator flaps*

Introduction

Elbow defects form a challenging subgroup to reconstruct among upper extremity defects. Being in an extremely mobile area and having subtle subcutaneous fat layer, makes posterior elbow region defects puzzling to physicians. Limited local soft tissues are frequently disrupted by trauma or lie in trauma zone. Thus, they are not reliable unless used for minor defects. Range of motion for an elbow joint is calculated biomechanically to be 27° to 149° of flexion for contemporary daily tasks [1]. Soft tissue coverage for posterior elbow defect must be congruent with margins of this flexion range.

For reconstruction of elbow defects, use of regional and distant flaps are couraged, due to aforementioned reasons [2]. We aimed to present a successful case of elbow defect reconstructed by a radial collateral artery perforator flap (RCAPF), also to discuss the advantages and applicability of this flap in light of current literature.

Case Report

A 48-year-old male patient was consulted to our clinic for a defect of right elbow skin and exposure of olecranon. Defect etiology was chronic bursitis of elbow joint. Patient presented with a history of 48 pack a year of cigarette smoking without any diagnosis of chronic illness. He had undergone an attempt of local flap closure, which failed and lead to enlargement of the defect.

After a through debridement and bursectomy, RCAP-flap of 13x5,5cm was planned to cover a defect of 5x4,5cm. Two perforators were marked preopera-

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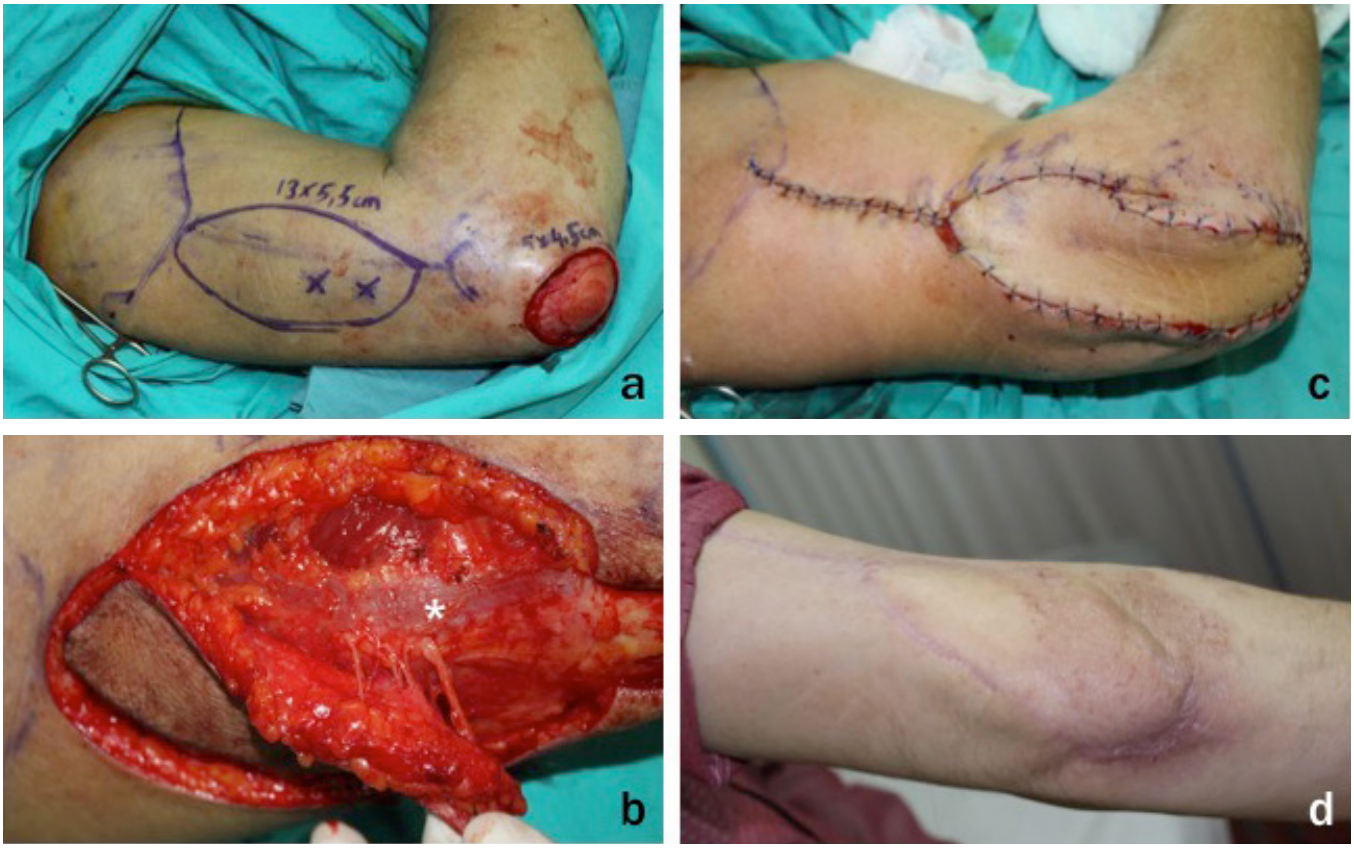

Figure 1. (a) Preoperative planning of the flap and the defect. **(b)** After elevation of flap, * marks the chosen perforator. **(c)** After flap is adapted to defect. **(d)** Postoperative view after 3 months, joint held at full extension.

tively by a hand-held Doppler, along lateral intermuscular septum. The RCAP-flap was dissected suprafascially starting from the lateral incision. Two perforators were found penetrating deep fascia, matching the areas of preoperative marks. The distal perforator was clinically evaluated to be insignificant for flap perfusion and flap was re-designed for proximal perforator to be the new pivot point. Flap elevation was completed with dimensions of 13 to 5,5cm. The RCAP-flap was rotated 170° clock-wise to cover the defect. Distal perforator was ligated as it hindered the flap rotation. Flap donor area was sutured primarily.

Elbow was immobilized at anatomic position for two weeks with a splint. During follow-up a 0,7to 1cm area of partial marginal necrosis occurred, which was healed with local wound care. No limitation was noted in motion range of elbow joint. Functionally and aesthetically satisfying outcomes was obtained (Figure 1).

Discussion

Elbow defects are challenging defects to reconstruct due to joint mobility and limited soft tissue reserve. For reconstruction of the region, successful examples of axial fasciocutanous flaps such as radial forearm and reverse lateral arm flaps, interpolation flaps elevated form abdominal region, pediculed lattissimus dorsi musculocutenous flap and various free flaps are defined throughout the literature [1,3-5].

RCAP-Flap's prominent features when compared to conventional reconstructive options are; 1) being a perforator flap and obviating the need for microsurgical anastomosis, 2) being elevated from the defect region, 3) confining the reconstruction to a single stage 4) preserving the motor function of arm muscles. As being a suprafacial flap, it obviates the need for intramuscular dissection, in contrast with triceps dissection performed in lateral arm flap, and 5) taking no more

than 90 minutes to elevate the flap, the procedure is straight forward.

Perforator based flaps are gaining popularity among first tier options for lower extremity defects, especially in distal tibia and ankle region. Yet, the application of perforator-based propeller flaps to upper-extremity reconstruction is still limited [6]. Anatomic variations of the perforators encountered during surgery are one of the reasons that limit frequent use of perforator flaps, in upper-extremity. Hwang and colleagues documented that lateral sided perforators of the arm, rarely show anatomic variations [7]. RCAP-flap is nourished by perforators from Posterior Radial Collateral Artery (PRCA), which is the pedicle for lateral arm flap. Commonly three skin perforators are branched from PRCA [7-9]. Although the reference points are distinct in each article, in a simplistic manner; three perforators that pierce the deep fascia along the intermuscular septum can be found at 5^{th}, 8^{th} and 11^{th} centimeters proximal from lateral epicondyle of the humerus. In the case presented, our flap was based on second perforator.

Flap is planned in a similar fashion to lateral arm fasciocutaenous flap. Interconnecting line drawn from the insertion of deltoid muscle to lateral epicondyle marks the lateral intermuscular septum. Just lateral to this line, perforators can be marked with an acoustic Doppler at designated perforation points. Flap design is tailored to defect and location of perforators, hence planning must be flexible for variations in perforators. Suprafasical dissection is performed through lateral incision and after existence and adequacy of perforators are verified, incisions are completed to form a skin island. In our case, a single perforator was included, as the rotation angle was 170°. More than one perforator can be incorporated to skin island for lesser rotation angles [10].

Lateral arm flap donor sites as wide as 7.5cm can be closed primarily without the need for skin graft [11]. Our perforator flap width was 5.5cm and the donor area was sutured linearly without tension.

We did not found any in vivo study revealing the measures of exact skin island, which only a single perforator nourishes. Furthermore, Murakami and colleagues manage to raise a 13x5cm skin island safely, incorporating 2 perforators [10]. Ayesteray et al., in a case of ulna defect, performed the soft tissue reconstruction with a single perforator 15x6cm flap [12]. In the case presented here, flap dimensions were 13x5.5 cm and based solely on a single perforator. We claim this dimensions to be clinically safe. We prefer to blame on ongoing cigarette consumption, during postoperative period, for partial marginal necrosis of 0,7x1cm.

After soft tissue reconstructions of elbow, maintaining joint at anatomical position of extension is suggested [13]. We argue that no more than fourteen days of splint immobilization of elbow joint is adequate.

Conclusion

We conclude that the RCAP-flap is a sound option for elbow region reconstruction and must be considered among conventional reconstruction alternatives.

Conflict of interest statement

The authors have no conflicts of interest to declare.

References

1. Morrey BF, Askew LJ, Chao EY. A biomechanical study of normal functional elbow motion. J Bone Joint Surg Am 1981; 63:872-7.
2. Pederson W. Nonmicrosurgical Coverage of the Upper Extremity. In: Wolfe S, Pederson W, Hotchkiss R, Kozin S (eds.) Green's Operative Hand Surgery - Volume 2. Churchill Livingstone, London, 2010;1645-720.
3. Lazarou SA, Kaplan IB. The lateral arm flap for elbow coverage. Plast Reconstr Surg 1993;91:1349-54.
4. Lewis V, Cook J. The nondelayed thoracoepigastric flap: coverage of an extensive burn defect of the upper extremity. Plast Reconstr Surg 1980;65:492-3.
5. Mordick T, Britton E, Brantigan C. Pedicled latissimus dorsi transfer for immediate soft tissue coverage and elbow flexion. Plast Reconstr Surg

1997;99:1742-4.
6. Ono S, Sebastin SJ, Yazaki N, Hyakusoku H, Chung KC. Clinical applications of perforator based propeller flaps in upper limb soft tissue reconstruction. J Hand Surg Am 2011;36:853e63.
7. Hwang K, Lee WJ, Jung CY, Chung IH. Cutaneous perforators of the upper arm and clinical applications. J Reconstr Microsurg 2005;21:463e9.
8. Hennerbichler A, Etzer C, Gruber S, Brenner E, Papp C, Gaber O. Lateral arm flap: analysis of its anatomy and modification using a vascularized fragment of the distal humerus. Clin Anat 2003;16:204e14.
9. Chang EI, Ibrahim A, Papazian N, Jurgus A, Nguyen AT, Suami H, et al. Perforator Mapping and Optimizing Design of the Lateral Arm Flap: Anatomy Revisited and Clinical Experience. Plast Reconstr Surg 2016;138:300e-6e.
10. Murakami M, Ono S, Ishii N, Hyakusoku H. Reconstruction of elbow region defects using radial collateral artery perforator (RCAP)-based propeller flaps. J Plast Reconstr Aesthet Surg 2012;65:1418-21.
11. Morrison CS, Sullivan SR, Bhatt RA, Chang JT, Taylor HO. The pedicled reverse-flow lateral arm flap for coverage of complex traumatic elbow injuries. Ann Plast Surg 2013;71:37-9.
12. Ayestaray B, Ogawa R, Ono S, Hyakusoku H. Propeller flaps: classification and clinical applications. Ann Chir Plast Esthet 2011;56:90-8.
13. Tung TC, Wang KC, Fang CM, Lee CM. Reverse pedicled lateral arm flap for reconstruction of posterior soft-tissue defects of the elbow. Ann Plast Surg 1997;38:635-41.