Decision Making in Skin Paddle Design of Pedicled Radial Forearm Flap

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Abstract- The Elbow is one of the functional big joints that is at risk of trauma, especially during traffic accidents. Although the reconstruction ladder is the priority, regional flaps have some advantages, including pliable tissues, being far from the danger zone of trauma, and having sufficient tissue. A 32-year-old man who suffered severe injury to the upper limb was referred for reconstruction. The fractured elbow had a plate that should be covered with sufficient soft tissue and skin. Proximally based fascio-cutaneous forearm flap, designed and harvested preserving perforators, and transferred safely. There are small septocutaneous perforators from the radial artery to the wrist skin. Fine microscopic dissection should be done to preserve this perforator to achieve a small skin paddle for harvest on the distal part of the wrist. The radial forearm flap should be considered in elbow skin defects. This proximally based flap has robust nourishment and can be harvested safely.

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Introduction

Soft tissue defects of the upper limb are not uncommon, as traffic accidents and battles mostly result in crush injuries of the upper limb. There are numerous reconstructive approaches that surgeons can use, respecting the reconstructive ladder (1). The development of transportation and medical instruments increased the number of admissions for upper limb reconstruction (2). Referral centers have enhanced surgical techniques and consider patients' concerns about the functional and aesthetic outcomes of reconstruction.

Among various surgical approaches, the radial forearm flap is a lifeboat, especially in upper limb injuries with exposed bone, tendon, or vessels. Reliable vascular pedicle, versatile perforator nourishment, and pliable skin paddle are vital elements to encounter radial forearm flap at first lines of flap selection (3,4).

The radial artery, among its direction in the forearm, sends branches to the radial side and midline soft tissues and skin until it reaches the hand and anastomoses with the ulnar artery. This is the logic in selecting the proper skin paddle in reconstructive goals, as best anastomoses will not result in best outcomes without considering perforator locations perforating fascia and entering skin.

Here, we presented our reconstructive case of radial forearm flap usage in the elbow region, which is usually the point of dilemma in selecting the best reconstructive choice. This work has been reported in line with the SCARE criteria (5). Before surgery, all the benefits and possible complications were explained to the patient, and after signing the consent forms, surgery was performed. The consent form was sent to the ethics committee to receive an ethics code for the study.

Case Report

A 32-year-old who had a traffic accident 4 months ago was admitted for upper limb injury reconstruction. He had undergone orthopedic surgery, and they inserted instruments for an elbow fracture. However, eventually, the skin and soft tissues over the device were disrupted, and they encountered exposed plate and bone on the dorsal aspect of the elbow (Figure 1). Conservative wound treatments were not effective, and they consulted

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for coverage.

The plan was to transfer robust, well-nourished tissue to control infection and provide reliable coverage with minimal aesthetic morbidity. upon normal Allen test and satisfaction with the patient's distal arterial arcs, a proximally based fasciocutaneous radial forearm flap was marked and harvested meticulously (Figure 2). This flap was inserted into the defect without any disfigurement and covered the exposed instrument completely, considering skin excursion during elbow movements (Figure 3).

The donor site was closed easily by primary closure of the pedicle route and a partial-thickness skin graft (Figure 4). The patient was satisfied with both sites, experiencing no movement limitations or aesthetic problems.

Figure 1. Soft tissue over the elbow joint

Figure 2. Flap harvesting with an attached long vascular pedicle

Figure 3. Elbow coverage with fascio- cutaneous radial forearm flap

Figure 4. Radial forearm flap closure by primary closure and skin graft

Figure 5. Good result in recipient and donor site after 3 weeks

Discussion

Soft tissue defects of the upper limb have both aesthetic and functional importance. A restricted range of motion around the big joints in the upper limb may result in significant morbidities and lost working days. Therefore, the concerns of governments focus on returning valuable work sources to their jobs as soon as possible. The increased incidence of upper limb traumas due to traffic accidents requires more manipulations.

Soft tissue and skin defects around the elbow region have a significant effect on daily personnel career, as elbow disabilities may decrease self-esteem, too. One of the considerable notifications is that sufficient reconstructive skin is available to allow for more flexion and extension of the joint. Primary closure and skin graft have their limitations, and surgeons may suggest radial fascio-cutaneous flaps. One of these flaps are propeller flaps which are based on known perforators and can give soft tissues to cover (6,7,8), but previous tries showed us that arc of rotation in some crushed cases are demanding and may provide little tissues, especially when we have problems around joints like elbow with more and more motions.

The radial flap has a robust blood supply in its territory along its route until it reaches the wrist area. So, flaps based on the radial artery are safe and reliable. There are perforators to the forearm and hand, which can be a basis for flap harvesting. The most significant

point is the density of perforators. Hekner *et al*., evaluated the perforators of the ulnar and radial arteries on fresh cadavers. They report that most of perforators in radial artery are located in the proximal part of distal third of artery and concluded if skin paddle designed in this site, then the transferred flap would have ideal and more reliable survival (9), other studies have similar results and recommend markings of skin paddle in radial artery perforator flap in the distal third of forearm.

This way, you reach a greater arc of rotation, which may allow for more proximal locations or around the elbow with better excursion. We decided to select this flap for our patient, as the defect was over the posterolateral side of the forearm, and it was possible to transfer the flap simply from the anterior part to the defect without any distortion.

McCrary *et al*., presented their idea about osteo-cutaneous radial forearm flap as reconstruction tool in instruments of any plastic surgeon by detecting local perforators in this area (10), as previously mentioned, always it should be kept in mind that every effort of harvest radial flap from middle forearm may result in shortcomings in the final fate. This problem is evident in crushed injuries of the forearm, which restricts traditional skin paddle markings. Any anatomical review of radial artery branches seems mandatory in such cases (8).

Fortunately, we do not have such limitations, and distal perforators were healthy and available for flap elevation safely, and ultimately recommend this flap, especially in elbow region defects, which need more pliable soft tissues for optimal function.

There are small septocutaneous perforators from the radial artery to the wrist skin. Fine microscopic dissection should be done to preserve this perforator to achieve a small skin paddle for harvest on the distal part of the wrist.

The radial forearm flap should be considered in elbow skin defects. This proximally based flap has robust nourishment and can be harvested safely.

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