



Case report

Newly repairing technique of deformed hand by a posterior interosseous flap in an infant: A case report

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ABSTRACT

Introduction: Many non-surgical methods were performed to repair the deformities in the skeletal system to avoid severe complications post-open surgery, especially within the childhood stage or below. We aim, in this case, to present a new technique for repairing bony deformities in the childhood stage, which fewer studies have to instigate its efficacy versus open surgery.

Case presentation: We present a 14-months-old infant with wrist extravasation injury at the neonatal stage (day 1), end with a right wrist volar contraction and complete loss of brain homunculus of the right hand.

Discussion: We used a reverse posterior interosseous flap to reconstruct the soft tissue and release the flexor tendons of the hand. The flap was conducted entirely and was rapidly adapted to the recipient beds to achieve good color and texture harmonies. Within following up for 12 weeks, the patient restored hand function.

Conclusion: More global cohort studies are required to compare precisely the efficacy between surgical options and the used technique in our case for salvaging deformities in childhood.

1. Background

The reverse posterior interosseous flap (RPIF) is a versatile flap beneficial in adult upper extremity reconstruction. This relatively thin flap consists of skin and fascia raised from the posterior aspect of the forearm irrigated by cutaneous branches of the posterior interosseous artery. Its most common indications involve skin losses around the wrist and the hand.

Free flaps usually remain the unique and the last option in such these defects. However, these applications have some specific and additional risks, which consist of the inadequate recipient or donor vessel sizes, difficulty of dissection, and intolerance to long-term anesthesia in infants, resulting in lower success rates in infant patients compared with those in adults [1–3].

Acellular dermal matrix (ADM) has been used in conjunction with split-thickness grafts for the treatment of significant full-thickness burns crossing the joint; ADM products are effective in wound coverage and allow for sufficient elasticity to prevent contracture over the joint, but we must recognize that these materials are costly and that just because they can be helpful in a given situation does not mean that they always offer improved clinical results [4].

This article aims to highlight the utility and versatility of the flap and to show the possibility of using this flap at the age of fewer than two years old group where dissection requires more attention because of its anatomic peculiarities.

This case has been written by following the scare checklist guidelines for writing case reports [5].

2. Case report

A 14-month-old girl had a right wrist volar contracture (Fig. 1 [a-c]) with random finger movements. The child's history mentioned an extravasation injury to the volar wrist with a drug substance on the first day of life, which developed into tissue necrosis in the suitable volar wrist skin two weeks later. By clinical examination, we found no ability to grasp objects or make purposeful hand movements with multiple scars on the abdomen. The girl underwent conservative treatment using repeated dressings for six weeks, which caused granulation tissue formation in place of the skin necrosis. The conservative treatment continued for three months and ended with the formation of scar tissue on the volar side of the right wrist with a moderate-grade wrist contracture. After that, conservative treatment continued using

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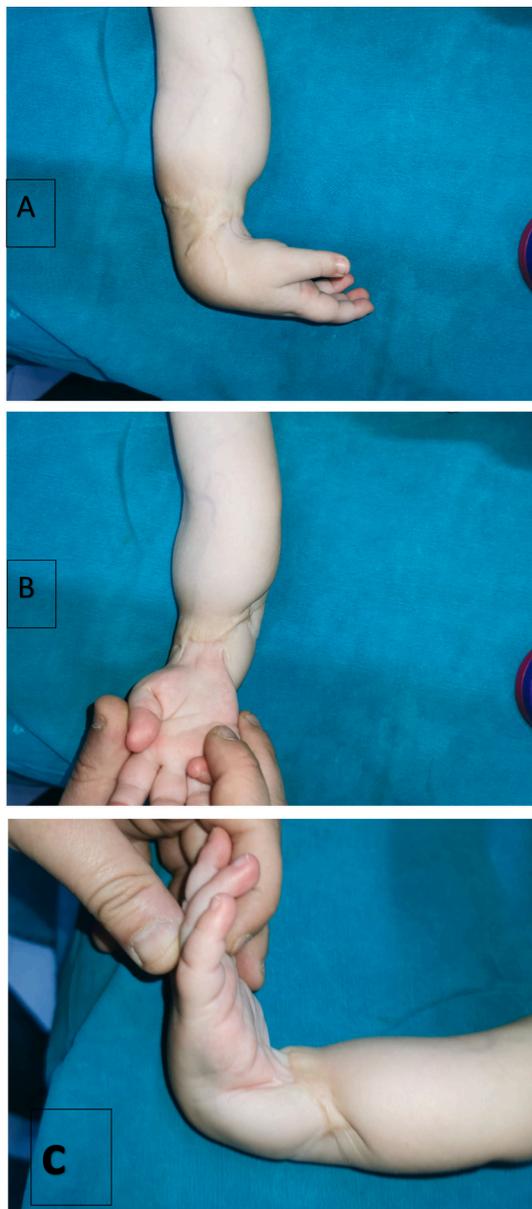


Fig. 1. (A) Lateral view wrist contraction 90 °C arrow pointing to the right elbow, (B) anterior view contracted skin graft arrow pointing to the right elbow & (c) medial view contracted skin graft.

emollient ointments, physiotherapy, and splints without improving contracture or scar laxity.

At the age of six months, the parents noticed weakness in the right hand's movement compared to the left hand with no using the right hand. A failed random abdominal flap with complete excision of volar wrist scar was performed, and at the age of eight months, surgical debridement of the volar wrist with random dorsal forearm flap with full-thickness skin grafting (Fig. 1). At the age of 1 year, the girl had a stiff wrist with random fingers movement, and the radiographs of the hand and wrist revealed normal bone development. All routine blood tests were within normal range. The operation was performed under general anesthesia. We found that the defect size was measured (3 × 3) cm and the hand's superficial and deep flexor tendons were short. So superficial and deep tendons were lengthened with the z-plasty technique, and carpal tunnel and median nerve were released. The flap axis was drawn between the humerus's lateral epicondyle and the ulna head, the elbow was flexed to 90°, and the forearm in pronation, long was 12

cm (Fig. 2). The required length of the pedicle was measured from the pivotal point, which was placed about 2 cm proximal to the distal radioulnar joint, to the most proximal edge of the defect. To leave the pedicle long enough and prevent vascular compromise due to elongation of the pedicle over the joints, we placed the pivotal point 2 cm proximal to the distal radioulnar joint. The flap is placed on the axis at a distance equal to this length from the pivotal point, and we use Doppler to check the perforator before surgery (Fig. 2). The skin flaps are raised over the deep muscle fasciae to determine the tendons of the extensor carpi ulnaris and extensor digiti minimi (Fig. 3). The vascular perforator was fairly small in diameter at this level, which was in the most superficial part of the septum (Fig. 4). After that, both lateral sides of the skin paddle were incised up to the muscle. The flap's deep fascia was sutured to the flap margins to avoid detachment and then raised towards the flap axis. At the most proximal end of the flap, where the posterior interosseous artery emerges from the supinator muscle, it was identified, ligated, and divided before entering the septum.

The septum is directly freed from the ulna's periosteum up to the pivotal point, and the flap is elevated together with the deep fascia and the septum. The tourniquet is deflated, and the flap perfusion is checked by marginal bleeding.

The flap is transferred to the defect site through the subcutaneous tunnel, which must be wide enough to avoid compression or torsion of the pedicle. Then, the flap perfusion is checked by a needle prickle (see Fig. 5).

The flap survived and rapidly adapted to the recipient beds to achieve suitable color and texture harmonies (Fig. 6A). We noticed significant improvement during the following up. There was no paralysis of the posterior interosseous nerve or other complications such as venous congestion, arterial insufficiency, suture detachment, and infection. And the parents were satisfied with the postoperative functional and esthetic improvements, and the patient restored hand function in 12 weeks.

3. Discussion

Herein, we reported a 14-month-old child with a right wrist volar



Fig. 2. 12 cm flap axis is drawn between the lateral epicondyle of the humerus and the head of the ulna back arrow. (3 × 3 cm skin island oval line).



Fig. 3. The vascular perforator of the posterior interosseous artery was checked with Doppler before surgery.



Fig. 4. Flap pedicle between the extensor carpi ulnaris and extensor digiti minimi muscle.

contraction and complete loss of the right hand's cerebral homunculus during the neonatal period (1st day). For soft tissue rebuilding and releasing of the flexor tendons of the hand, we utilized a reverse posterior interosseous flap, which survived the technique successfully and then was easily adjusted to the recipient beds to obtain appropriate color-shape harmony. The following up of the patient's situation revealed excellent results with no accompanying complications. The repairing method, in our case, represents a practical option for treating deformities in childhood. Dealing with pediatric surgical cases is one of the crucial challenges in reconstructive surgery, especially in cases related to functional restoration.

The reverse radial forearm flap (Chinese flap) is seldom used because of scarification of a major artery of the hand. The pedicled groin flap has been widely used for this aim [6], but bulkiness and the need for multistage procedures are the major drawbacks of this flap [7]. Despite that, there are also various free flaps, which mainly include scapular

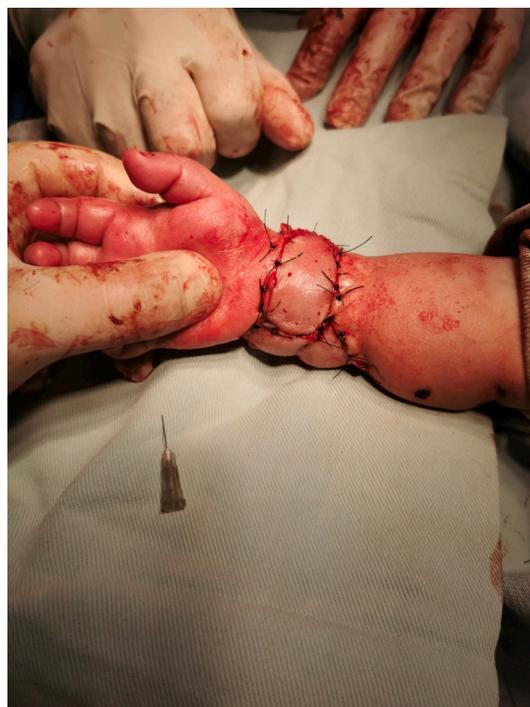


Fig. 5. Flap inset and perfusion are checked by needle prickle.

parascapula [8], groin [9], lateral arm [10], and lateral thigh flaps [11], in the surgical armamentarium, most of them are too bulky and require secondary debulking procedures and may not obtain a good texture and color harmony.

The RPIF as an island fasciocutaneous flap based on the posterior interosseous artery was first described by Zancolli and Angrigiani in 1986. Penteado and associates [12] introduced the vascular anatomy of the flap in the same year. Some modifications related to the RPIF have progressively been developed in the literature. Tonkin and Stern [13], and more recently Park et al. [14], successfully used the free versions of the flap in clinical series. Park et al. also raised 13 sensory flaps incorporating the posterior antebrachial cutaneous nerve in their series. Costa and coworkers [15] and currently Akin et al. [16] applied the osteocutaneous RPIF to the thumb and metacarpal defects. Shibata et al. [17] 10 combined the flap with the lateral arm flap for the defects that would require flaps larger than the RPIF. Mazzer and colleagues applied the direct flowed (anterograde) posterior interosseous flap to the elbow defects in 2 cases. Gupta and coworkers [18] presented an interesting maneuver in which the RPIF was passed through a hole in the interosseous membrane to extend the flap's reach to the volar side. Chen and colleagues [18] supercharged the flap with an additional venous anastomosis to prevent congestion and make it more reliable. Brunello et al. [19] based the flap on an exteriorized pedicle while maintaining the wrist in slight extension with a splint for three weeks to make the flap reach the relatively distant regions of the hand such as the finger dorsum, Onder Tan present 10 cases with mean age 9.1 years with successful results.

The vascular pedicle was quickly distinguished with its normal courses and size in the septum despite the mean age of 14 months old [20].

4. Conclusion

An experienced practitioner should investigate all hand injuries because extravasation injuries can lead to dire consequences unless they are managed correctly. Doppler perforator investigation increases the success rate in pediatric flap surgery. More global cohort studies are



Fig. 6. (A) 12-week follow-up of the flap, and it achieved good color and texture harmonies & (B) skin donor sits black scar arrow, failed random dorsal forearm flap scar white arrow.

required to compare precisely the efficacy between surgical options and the used technique in our case for salvaging deformities in childhood.

Ethical approval

This case report didn't require review by Ethics committee, Aleppo university hospital, Aleppo University, Aleppo-Syria.

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Author contributions

All authors have contributed in writing and reviewing the manuscript.

Guarantor

Sarya Swed.

Registration of research studies

N/A.

Consent

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Declaration of competing interest

All authors have declared no conflict of interest between the authors.

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