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Reverse first dorsal metacarpal artery flap repair of a right thumb epidermis granuloma: A case study

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Abstract. One case of epidermal granuloma of the right thumb was diagnosed by color Doppler ultrasonography and pathologic examination. Epidermal granuloma resection and reverse island skin flap transplantation were performed to determine the therapeutic effect of a reverse first dorsal metacarpal artery flap repair of an epidermal granuloma of the right thumb. After effective intravenous combined general anesthesia, the skin in the surgical field was disinfected and sterile drapes were placed. An oblique incision was made over the underlying epidermis granuloma. The right palm of the reverse first dorsal metacarpal artery flap was chosen. The pedicle was carefully protected, and the flap was transplanted to the defective skin area. The incision was sutured after hemostasis. A palpable mass with the dimension of the right thumb of the patient was measured by color Doppler ultrasonography and physical examination pre-operatively. The palpable mass was oval in shape and protruded from the skin surface. The palpable mass had an unclear boundary with the surrounding skin and therefore the skin should be removed. If the tendon is exposed after the resection, complications may occur after operation, such as skin necrosis and tendon exposure. Intra-operatively, the mass was 1.5x1.0 cm in size and multi-cystic. The boundary between the palpable mass and the surrounding skin could not be discerned. The skin area (1.5x1.0 cm in size) was completely invaded by the palpable mass, which was closely adhered to the surrounding tissue. The palpable mass was carefully dissected with appropriate protection to the finger nerves and arteries. The palpable mass and affected skin were completely removed, leaving a defect area of ~1.5 x1.0 cm without skin. The reverse first dorsal metacarpal artery flap was used to repair the defect area. The repaired flap had a good blood supply and peripheral circulation. The operation was successful, and the anesthesia effect was satisfactory. Treatment of a thumb epidermis granuloma with reverse first dorsal metacarpal artery flap was shown to be a feasible strategy with a broad clinical application.

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Introduction

A granuloma is a well-defined nodular lesion formed by macrophages and cell-specific infiltration and proliferation (1-5). Reports involving epidermal granulomas in the right thumb of children are rare. The current treatment methods are conservative, including oral administration and topical ointments, most of which involve glucocorticoids as first-line drugs. There are no reports of surgical treatment (6-9). One case of a pediatric right thumb epidermis granuloma was treated at Changchun Children's Hospital (Changchun, China). The course of the disease was long, and there were no typical skin rashes, papules, or other symptoms. The current case was an atypical granuloma. Since conservative treatment was ineffective, granuloma resection was recommended as a radical method. The difficulty with surgical treatment is covering the skin defect after complete resection of the granuloma, which can be overcomed by using a full thickness skin transplantation, free skin flap, or island skin flap. In this case, because the patient was young, in order to reduce post-operative complications, we performed an epidermal granuloma resection and reverse metacarpal artery flap transplantation. We showed that a reverse first dorsal metacarpal artery flap was successfully used to repair the right thumb epidermis granuloma and satisfactory results were achieved.

Patients and methods

General information. The study was approved by the Ethics Committee of Changchun Children's Hospital. The child who participated in this research had complete clinical data and the parents of the child signed the informed consent form. The patient was a female (5 years and 8 months of age) who was hospitalized for 7 days. The child was admitted to Changchun Children's Hospital for a painless palpable mass on the right

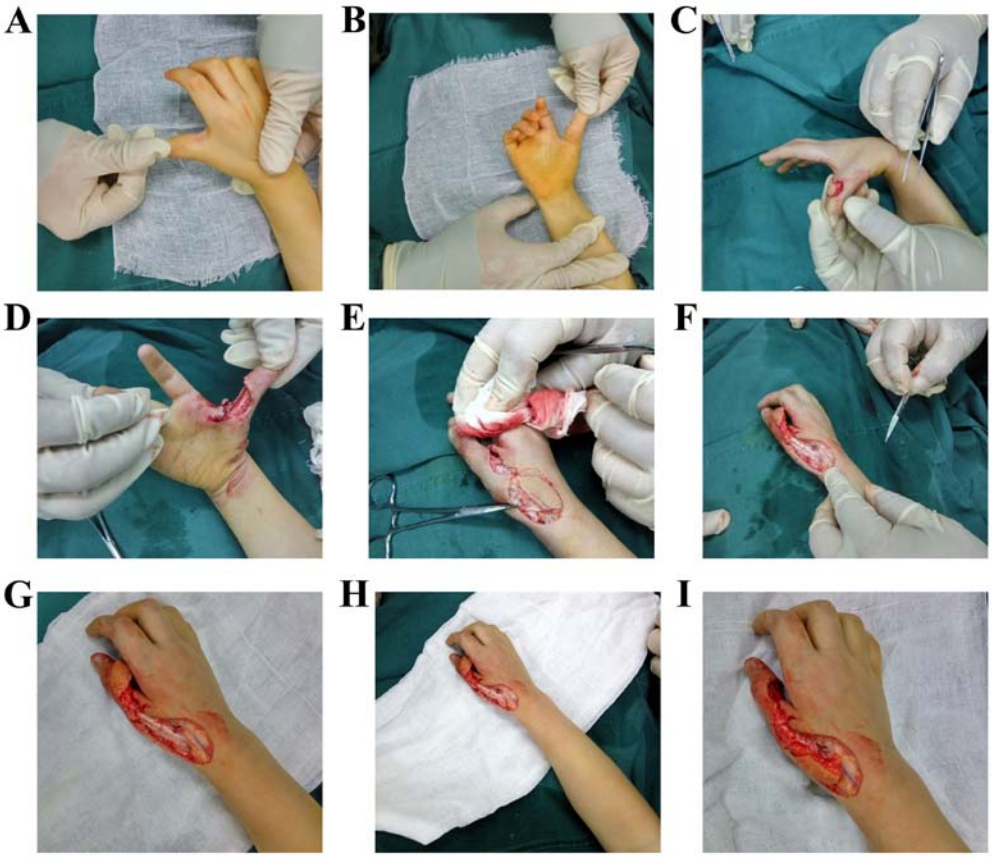

Figure 1. Epidermal granulomatectomy and reverse island flap transplantation. (A) Frontal view of thumb mass; (B) lateral view of thumb mass; (C) dorsal skin defect area after resecting mass; (D) palmar skin defect area after resecting mass; (E) designing and cutting equal proportion skin flaps; (F) transferring pedicled skin flap to skin defect; (G) covering defect area with reverse flap and observing the length of the pedicle; (H) covering defect area and observing the repaired flap having good blood supply; (I) putting the flap back and observing the length and width of the pedicle and blood supply of the flap.

thumb for 1 year. On examination, the palpable mass was 0.4x0.2 cm and 0.3x0.2 cm in size, located on the palmar side of the proximal phalanx of the right thumb. The mass was oval and protruded from the skin surface, and had an unclear boundary with the surrounding skin. The color of the mass was the same as that of the normal skin. The palpable mass was soft to touch without tenderness or pain, and demonstrated volatility with touching. The associated finger was flexible with free movement. Color Doppler ultrasonography confirmed that the local mass was on the right thumb [Changchun Children's Hospital (2016.07.06)].

Surgical procedure. As shown in Fig. 1, the patient underwent a pre-operative examination, and was placed in the supine position during surgery. The right upper extremity was abducted at 90˚ on the surgical table. After effective intravenous combined general anesthesia, the skin in the surgical field was disinfected, and sterile drapes were placed. An oblique fusiform incision was made slightly smaller than the right thumb mass, ~2.0 cm long, the skin was cut, and epidermal granuloma resection was performed. The right palm of the reverse first dorsal metacarpal artery flap was chosen. The pedicle was carefully protected, and the flap was transplanted to the defective skin area. After cutting the skin to the same proportion as the snuff-socket, the perforator branch of the first dorsal metacarpal artery and a few tissues were retained as the pedicle of the skin flap. After measuring the distance of improvement, the skin flap was transferred to the palmar side of the proximal phalanx of the right thumb. The incision was sutured after hemostasis was achieved. The dissected mass was sent for pathologic examination.

Results

We managed a rare case involving an epidermal granuloma in the thumb of a child that was treated with surgery. The pathologic analysis is shown in Fig. 2. The blood supply of the flap was good, the peripheral circulation was good, and the post-operative suture healed well (Fig. 3). Practice has proven that the reverse first dorsal metacarpal artery flap is an effective method for the treatment of a thumb palmar epidermal granuloma, and can be used as a reference.

Discussion

The first dorsal metacarpal artery flap is a common method to cover skin defects of the thumb palmar in adult microsurgery. The first dorsal metacarpal artery flap is a simple and easy operation. The most difficult part of this method when the patients are young is that the arteries are thinner. To ensure the survival of the skin flaps, a precise pre-operative design and careful operation are required. Our aim was to provide a flexible method of treatment. Not all granulomas need surgical treatment and skin flap transplantation. We have encountered

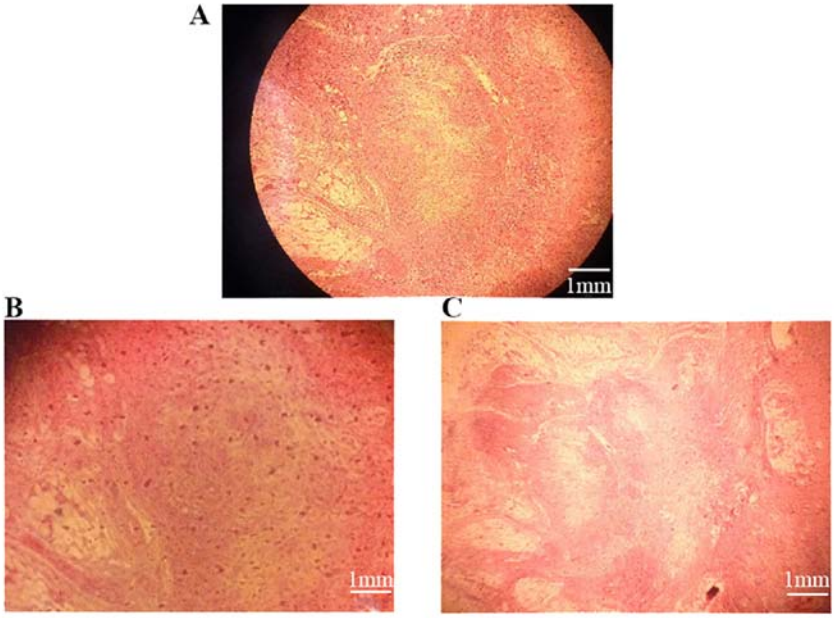

Figure 2. Pathological analysis of granuloma annularis. Pathological image with (A) 4 multiples, (B) 10 multiples, and (C) 40 multiples under a microscope.

Figure 3. Complete survival of flap transplantation after operation. (A) Frontal view, (B) oblique view, and (C) lateral view of complete survival of flap after 2 weeks.

different diseases and treatments, and application of microsurgical treatment for skin diseases is a good choice.

The practical anatomy of the reverse first dorsal metacarpal artery flap has been reported. The blood supply of the flap stems from the brachial artery branch of the radial artery, which is associated with the snuff pocket (8,10). The major body is deep in the hallucis longus tendon muscle and crosses through the dorsal aspect of the interosseous muscle, preceded by a posterior tibial artery, which is the axial branch of the flap that provides the main blood supply. The blood supply of the reverse first dorsal metacarpal artery flap is mainly from the dorsal carpal branch of the deep branch of the radial artery originating from the snuff-box. Its main trunk is in the deep side of the extensor pollicis longus tendon, and then through the front of the first dorsal interosseous muscle, which sends out the dorsal radial artery of the index finger, and anastomoses with the dorsal branch of the proper digital artery of the index finger to form a chain vessel. The artery is in line with the dorsal collateral branch of the index finger to form chain-like blood vessels (1,6). The nerve branch is derived from the superficial branch of the radial nerve. The wrist branch of the radial nerve, which is associated with the deep fascia of the wrist, supports the skin sensation of the area. It was mainly dominated by the wrist dorsal nerve branches. According to the anatomic features of the first dorsal metacarpal artery, the flap could be dissected from the proximal end located near the plane of the second metacarpal base to the distal end located at the metacarpophalangeal joint on the dorsal side of the index finger. The flaps on both sides should not cross beyond the midline of the index finger. The flap was 9-10 cm in length, 2.0-2.5 cm in width, and the dorsal palm was ~4 cm (not posterior palm).

There are three advantages over using the reverse first dorsal metacarpal artery flap in repairing the thumb skin defect. First, the first dorsal metacarpal artery flap had a highly reliable blood supply, required simple surgical techniques, and showed a high flap survival rate. Second, the texture of the flap and thumb skin was similar, which ensured good cosmetic results. The flap contained the cutaneous nerve, which benefited the recovery of skin sense. Third, the wound had limited impact to the donor area. Suture could be applied to the small donor area, whereas the entire large skin graft transplantation could be utilized for the large area. Functional recovery was satisfactory.

There were also some disadvantages in this study. Because the donor area was located on the hand, the skin graft from

a large flap area would have specific pigmentation and the shape could be affected. Generally, the shape was satisfactory. During the operation, the free first dorsal metacarpal artery was avoided to ensure that the accompanying vein and cutaneous nerve were contained in the pedicle. In addition, during the process of the free first dorsal metacarpal artery, the artery can be damaged, crushed or even embolized, which could result in a dysfunctional flap. Moreover, there is a certain gap left during flap transfer, rather than a completely sutured and closed incision. The open tunnel could be utilized to effectively reduce the pressure on the pedestal. Even if pressure inevitably occurred, this open tunnel approach made it easy to handle the issue. Therefore, an open tunnel was highly favored. With the various surgical methods for repairing thumb skin defects, the reverse first dorsal metacarpal artery flap is a simple and practical method with highly satisfactory recovery rates of finger function and shape.

In conclusion, the operation was successful and the anesthetic effect was satisfactory. The treatment of thumb epidermis granuloma with the reverse first dorsal metacarpal artery flap was shown to be a feasible strategy with a broad clinical application.

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Availability of data and materials

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Authors' contributions

ZL wrote the manuscript. BL analyzed and interpreted the patient data. ZL and HJ performed the surgery. FG and BY were responsible for the analysis and discussion of the data. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Changchun Children's Hospital (Changchun, China). The child who participated in this research had complete clinical data. The parents of the child signed the informed consent form.

Patient consent for publication

The parents of the child signed the informed consent form and agreed to the publication of the data of the present study.

Competing interests

The authors declare that they have no competing interests.

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