Clinical case
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Bilateral reconstruction of palmar soft tissues defects of the hands after thermal injury

E.M. Biktasheva, B.Sh. Minasov, M.M. Valeev✉, R.R. Yakupov, T.B. Minasov, T.R. Mavlyutov

Bashkir State Medical University, Ufa, Russian Federation

Corresponding author: Marat M. Valeev, valeevmm@rambler.ru

Abstract

Introduction Thermal injury to the palmar surface of the hand is usually complicated by flexion desmogenic contracture of the finger joints. This condition is more complicated with significant wound areas and depths of soft tissue destruction. Conventional surgical methods and soft tissue reconstructions may fail to provide full restoration of the hand function.

The objective was to present the optimal treatment strategy for patients with scar flexion contractures of the fingers after thermal injury to the palmar surface of both hands using a pediatric case report.

Material and methods A child aged 2 years and 4 months underwent surgical treatment to include excision of scars, skin grafting of both hands with a vascularized fasciocutaneous flap raised with the radial artery.

Result The patient could regain all types of hand grip on both sides 12 years after surgical treatment. Both hands were aesthetically acceptable.

Discussion Treatment of patients with thermal injury and substantial soft tissue damage is a complex disease process. Conservative treatment and surgical procedures using non-vascularized skin flaps are normally used for the condition. These approaches are associated with cicatricial and arthrogenic flexion contracture of the finger joints. The radical treatment includes thorough wound debridement and early flap coverage and wound closure using a flap with an axial-pattern blood supply, free flaps and reverse-flow flaps. The surgical approach helps to avoid flexion contracture of the fingers initiating early restoration of professional, social stereotypes and stereotypes in everyday life.

Conclusion The clinical observation has shown the possibility of one-stage organ-preserving surgical treatment using flaps with an axial blood supply.

Keywords: hand injury, thermal burn, cicatricial deformity, plastic surgery, microsurgery

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INTRODUCTION

Thermal injury to the soft tissues of the palmar surface of the hand can be associated with flexion desmogenic contracture of the fingers. Treatment would be dependent on the severity and depth of soft tissue damage, resources available for mobilization of healthy tissues and specific skin architecture on the palmar surface of the hand [1-7]. The case becomes more complicated with combined injury to the covering tissues and other anatomical formations of the hand (bone fractures, injury to tendons, blood vessels and nerves), which is associated with impairment of fine motor skills, negative psychological effects in an individual, depression, psychological and emotional changes in a child [8-15]. Reconstruction of soft tissue defects in the hand is essential and can be performed with modern surgical technologies [16-20].

MATERIAL AND METHODS

A boy of 2 years and 4 months grew up and developed uneventfully. At the age of 2 years, during a picnic, the child fell into the embers of a bonfire receiving burns of both hands. Dressings were performed after radical necrectomy in the burn department. The wounds healed by secondary intention. Physical examination revealed a hypertrophic scar on the palmar surface extending to the fingers of the left hand and flexion desmogenic contracture of the fingers. There were no active movements in the fingers. Passive movements of the fingers could not be produced being severely painful. All types of hand grip were impaired (Fig. 1a). Flexion desmogenic contracture of the 3rd and 4th fingers was noted in the right hand. Active extension movements in the fingers amounted to 90 degrees. The main types of hand grip were limited (Fig. 1b).

Fig. 1 Preoperative appearance of both hands: (a) left side; (b) right side

Stages of postoperative rehabilitation were discussed with the parents prior to surgery. Amputation of the 5th finger of the left hand was offered for functional reasons. Surgical intervention performed on December 12, 2007 under general anesthesia included excision of scars on the palmar surface,

amputation of the 5th finger, reconstructive surgery for the left hand using a vascularized fasciocutaneous flap.

Description of the operation: the patient was positioned supine with the left upper limb abducted. Scars on the palmar surface of the hand were excised after the limb was properly treated. A skin defect measuring 5.0 by 8.0 cm and covering the entire palmar surface, the main and middle phalanges was revealed. The fifth finger was amputated, and a skin flap from the dorsal surface of the finger was translocated to the palm defect (Fig. 2).

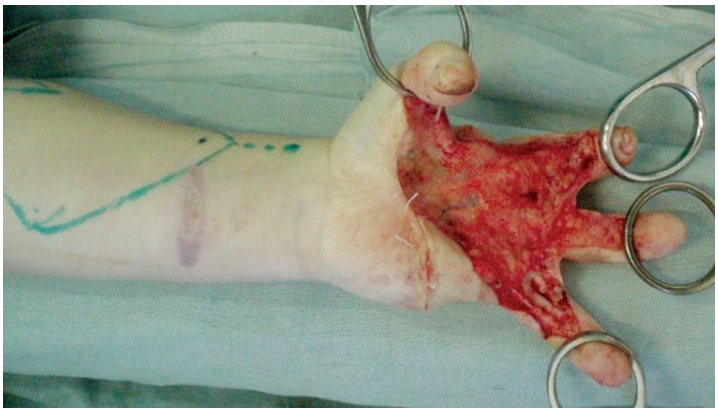

Fig. 2 Appearance of the left hand with scars excised and the fifth finger amputated

The radial artery and accompanying veins of the anatomical snuffbox were exposed in the proximal direction of the forearm and a fasciocutaneous flap of the appropriate size was provided to close the skin palmar defect (Fig. 3).

Hemostasis was provided during surgery. The flap was rotated on the vascular pedicle to the palmar defect and fixed with interrupted sutures. The donor wound was closed with a split skin flap. Aseptic dressings were applied. The operating time was 3 hours 20 minutes. Blood loss during surgery was 40 ml. The procedure and anesthesia were uneventful.

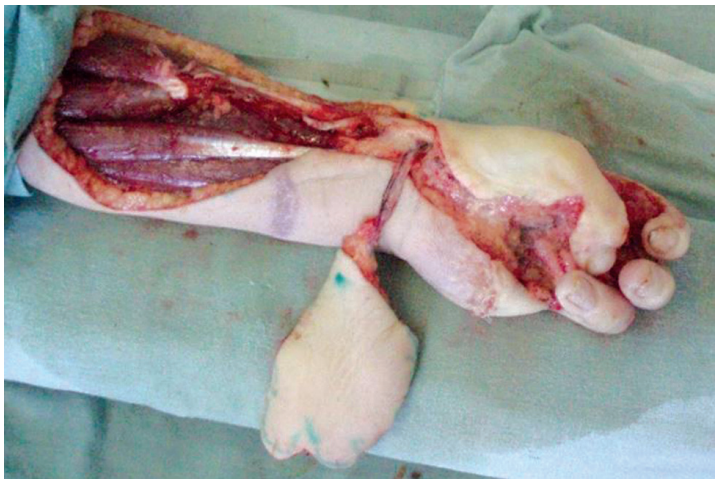

Fig. 3 The stage of isolating a fasciocutaneous flap on the distal vascular pedicle on the left forearm

Reconstructive surgery performed on the right hand four months later included anesthesia, treatment of the surgical field and the patient was positioned supine on the operating table. A skin defect formed on the palmar surface of the 3rd and 4th fingers after excision of scars on the right hand (Fig. 4).

Fig. 4 Appearance of the right hand with scars excised

The distal part of the radial artery and accompanying veins were exposed on the right forearm and a simulated fasciocutaneous flap on a vascular pedicle of the appropriate size was isolated to close the skin defect on the palmar surface of the 3rd and 4th fingers (Fig. 5).

Fig. 5 The stage of isolating a fasciocutaneous flap on the distal vascular pedicle on the right forearm

Hemostasis was performed by electric coagulation and ligation of blood vessels during the operation. The autograft was moved on a vascular pedicle to the defect area on the palmar surface of the 3rd and 4th fingers and fixed with interrupted sutures. The donor wound was sutured with local tissues. Aseptic dressings applied. The operating time was 100 minutes. Blood loss was 30 ml. The operation and early postoperative period were uneventful.

RESULTS

The skin flaps have taken root. The wounds healed by primary intention. The patient completed a full course of rehabilitation. Two years later, local plastic surgery was required to form the interdigital space between the 3rd and 4th fingers. The boy is being followed up by the operating surgeon (Fig. 6).

Fig. 6 Long-term result of surgical treatment: (a, b) 3-year follow-up; (c, d) 12-year follow-up

DISCUSSION

Literature review showed that treatment strategy for patients with thermal trauma and significant soft tissue damage in hand still is controversial [13, 16]. Three treatment options are available for the patients. Conservative treatment is aimed at closure of the wound defect [2, 4, 5]. The patient was treated with dressings that resulted in the development of cicatricial flexion contracture of the fingers on both sides. Surgical treatment can be produced using non-vascularized skin autografts. These methods, already at the stage of preparation for plastic surgery, are associated with scars to be followed by arthrogenic flexion contracture of the joints of the fingers, apart from a long-term favorable functional outcome of such operations [6, 10, 18]. Other researchers support the radical treatment including thorough wound debridement and early flap coverage and wound closure using a flap with an axial-pattern blood supply, free flaps and reverse-flow flaps [7, 8, 9, 11, 12, 15, 16, 20]. The surgical approach we used in the case helps to avoid flexion contracture of the fingers initiating early restoration of professional, social stereotypes and stereotypes in everyday life.

CONCLUSION

Earlier surgical intervention is practical to include radical debridement with the demarcation line identified and closure of the resulting soft tissue defect using a flap with an axial-pattern blood supply to avoid the development of flexion desmogenic contracture of the joints of the fingers. The outcome of the case presented suggest that the treatment strategy can be optimal for patients with thermal injury and soft tissue injury to the palm of the hand. The reverse radial forearm fascial flap can be the method of choice for soft-tissue reconstruction of the hand with extensive scarry deformity of the palm and desmogenic flexion contracture of the fingers.

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Ethical review *TThe study was approved by the local ethics committee of the Bashkir State Medical University (Protocol No. 10 of October 23, 2022).*

Written ***informed consent*** *for the participation in the research project was obtained from the subject's parent/ legally acceptable representative.*

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Information about the authors:

Elina M. Biktasheva – Candidate of Medical Sciences, assistant, dr.elinabiktasheva@yandex.ru, https://orcid.org/0000-0001-6056-8819;

Bulat Sh. Minasov – Doctor of Medical Sciences, Professor, Head of the Department, B.minasov@ya.ru, https://orcid.org/0000-0002-1733-9823;

Marat M. Valeev – Doctor of Medical Sciences, Professor, Professor of the Department, valeevmm@rambler.ru, https://orcid.org/0000-0002-64-38-8820;

Rasul R. Yakupov – Doctor of Medical Sciences, Professor, Professor of the Department, rasulr@mail.ru, https://orcid.org/0000-0001-7650-1926;

Timur B. Minasov – Doctor of Medical Sciences, Professor, Professor of the Department, m004@yandex.ru, https://orcid.org/0000-0003-1915-3830;

Tagir R. Mavlyutov – Doctor of Medical Sciences, Assistant Professor, mavlutovtagir@mail.ru, https://orcid.org/0000-0002-5398-9356.

Contribution of the authors:

Biktasheva E.M., Minasov B.Sh., Valeev M.M. – conceptualization; methodology; validation; formal analysis; conducting research; data processing; preparation and writing of the initial version of the article; scientific editing; preparing work for publication; control; project management.

Yakupov R.R., Minasov T.B., Mavlyutov T.R. – formal analysis; conducting research; data processing; scientific editing; preparing work for publication.