

Use of the omental free flap for reconstruction of degloving hand and foot injuries: two case reports

Case report

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Abstract: Different techniques are used for reconstruction of degloving hand or foot injuries, however the best option has not been found yet. In this paper we present two clinical cases when degloving hand and foot injuries were successfully covered with the omental free flap.

Keywords: Degloving injuries • Omental free flap • Microsurgical technique

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1. Introduction

Even though the most complicated injuries can be repaired by using microsurgical technique, the reconstruction of degloving hand or foot injuries remains a great challenge because these injuries are complex, shallow and important structures of the limb (e.g. tendons, muscles, nerves, bones) are usually exposed. The degloved tissue defects have an unfavorable bed for skin grafts, so if a split-thickness skin graft is transferred on exposed skeletal structures, necrosis of the graft is very likely to develop [1]. That is why a thin, very pliable, large and well vascularized free flap is the best choice for the reconstruction of degloving hand or foot injuries [1-3]. The problem is that it is hard to find all these features in a single flap. Nowadays degloving injuries are covered with fasciocutaneous [2-5], perforator-based cutaneous [1,3,6] or musculocutaneous [2,3,7] free flaps. All of the

methods mentioned above have disadvantages and are not ideal choices for reconstruction of extensive hand or foot injuries. For example, the size of fasciocutaneous flaps is limited and large tissue defects cannot be covered [4], donor site morbidity is unfavourable when radial forearm or temporoparietal fascial flaps are harvested [4,5] and a radial forearm flap cannot be used if Allen's test indicates an inadequate collateral blood circulation of the hand [4]. Myocutaneous (e.g. latissimus dorsi) flaps are not suitable for reconstruction of degloving hand injuries because they are too bulky, not flexible and cannot adjust to irregular surfaces of the hand or be turned around fingers [2]. Among the disadvantages of using the perforator-based flaps are the technical difficulties of dissecting the perforator vessels and anatomical variations in their location [1], extensive donor site morbidity and quite high incidence (about 13,7%) of the flap's initial temporary vascular insufficiency which

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can result in partial flap loss [6]. Because of all these reasons, surgeons are trying to find other ways to repair tissue defects by using microsurgical technique. One of the alternatives is the usage of the omental free flap [2,8]. It has special structural, functional and anatomical features that can make it a better choice for reconstruction of extensive hand or foot injuries compared to other types of flaps [8,9]. The omental flap is thin, pliable and can be transferred to a tissue defect with poor recipient vessels because of its rich blood supply and a long vascular pedicle [8,9]. The ischemia time of the flap is long due to its low metabolic demand [8]. A very important advantage is that the omentum has a large surface (its length is about 14-36 cm, width – 23-43 cm and its surface can range from 300 to 1500 cm² [9]) therefore it can be used to cover extensive tissue defects. Besides, the omentum can be used as a gliding material which facilitates functions of tendons after extensive forearm tenolysis [8]. In the following section of this article we present two unique clinical cases of the patients with very extensive degloving hand and foot injuries. In order to avoid the amputation of a limb, a large but also thin and pliable free flap with rich vascularity was needed to reconstruct tissue defects. As other commonly used free flaps were not suitable in these particular cases, the free omental flap was chosen as the best option and successfully transferred to the degloved hand and foot.

2. Clinical case 1

A 45 year-old woman had a traumatic injury at work – a comb damaged her right hand. A degloving injury of the right hand was diagnosed in the emergency room. The skeletal structures of the hand were intact, except for the avulsed distal phalanges of the 4th and 5th fingers. The thumb was not affected, the sensibility of it was also preserved (Figure 1a, b).

It was decided to use the omental free flap for the reconstruction of the defect. The operation lasted for 4 hours. The flap was harvested by performing a median laparotomy and a part of omentum was transferred to the tissue defect. An end-to-side microvascular anastomosis between a right gastroepiploic artery and a radial artery and end-to-end anastomosis between a right gastroepiploic vein and a radial vein were performed over the anatomical snuff-box. The omental flap was turned around the hand and covered with a split-thickness skin graft. An additional split-thickness skin graft was used to cover the flap after one week (Figure 2). There were no complications during or after the operations.

One year later, two finger-separating surgeries were performed (Figure 3). The functions of the hand were partially restored, mainly due to the fact that the thumb was not traumatized and the sensibility of it was not affected.

Figure 1. Clinical case 1. A traumatic injury of the right hand – a degloved tissue defect (a). Avulsion of the distal phalanges of the 4th and 5th fingers. The thumb is not injured (b).



Figure 2. Clinical case 1. The degloved injury of the right hand was wrapped with the free omental flap and covered with a split-thickness skin graft.



Figure 3. Clinical case 1. One year after the injury. The patient's hand after finger-separating surgeries.



3. Clinical case 2

A 22 year-old male sustained trauma at work when his right foot was injured by a textile-tearing machine. A large degloved soft tissue defect was diagnosed in the emergency room—there was no skin on both dorsal and plantar surfaces of the foot. The heel was not injured (Figure 4). It was decided to use the omental free flap for the reconstruction of the defect. The laparotomy was performed, the flap was successfully harvested and transferred to the injured foot. Microvascular anastomoses were performed and the flap was covered with a split-thickness skin graft. After the operation, thromboses of microvascular junctions occurred. Another operation was performed to remove thrombi. There were no complications after the second surgery and the wound healed successfully (Figure 5). As the sensation of the heel was intact, the patient was able to walk (Figure 6).

Figure 4. Clinical case 2. An extensive soft tissue defect of the right foot. The skin is avulsed from the dorsal and plantar surfaces of the foot. The heel is not injured.



Figure 5. Clinical case 2. The tissue defect was covered with the omental free flap and a split-thickness skin graft.



Figure 6. Clinical case 2. The sensibility of the heel was preserved, so the patient was able to walk after the surgery.



4. Discussion

In cases of extensive hand or foot injuries the free tissue transfer is the most suitable method to reconstruct soft tissue defects [1-3]. The free flap choice depends on multiple factors such as the etiology, size and location of injury, exposure of vital structures [8], the availability of suitable recipient vessels, the wound's volume and surface area and possible donor site morbidity [3]. In cases of degloving injuries of the hand or foot the free flap should be large, thin, and pliable, allow tendon gliding, have rich vascular supply and offer good functional and aesthetic results [2,3]. However, the flaps that are commonly used to reconstruct degloved tissue defects, were not suitable for the presented clinical cases. Fasciocutaneous flaps, even though they have almost all characteristics mentioned above (thinness, pliability and the gliding surface) [4] would have been too small to cover the extensive tissue defects. Moreover, the possibility of using large and well vascularized myocutaneous flaps was eliminated because they would have been too bulky in both cases. Finally, the dissection of a perforator based skin flap would have been complicated and the donor site would have been extensively traumatized. Therefore an alternative method had to be found to reconstruct degloving injuries and the omental free flap was chosen as the best option in the cases presented.

To our knowledge, there are no facts in the English literature (PubMed/Medline, BMJ Group, Cambridge Journals Online, The Cochrane Library, EBSCO Publishing, Emerald management eJournals collection, Lipincott Williams & Wilkins, Oxford Journals Online, SAGE journals online, Springer Verlag and Taylor & Francis databases) about using the omental free flap for covering such extensive degloving hand or foot injuries as in the presented clinical cases (when almost all skin of the hand or the foot is removed). However, the cases of not so extensive degloving injuries of the

dorsum of both hands (the largest defect was 176 cm²), thermal or crush injuries, necrotising soft tissue infections, tissue defects after pitbull mauling were reported [8]. The transferred omental flap is usually covered with a split-thickness skin graft. After transplantation of the omentum, the wounds heal well, good aesthetic results and partial or full limb functions are achieved [8]. The omentum can be used to cover contour deformities, vascular grafts or alloplastic materials, obliterate dead-space due to its special anatomical, structural and functional features [8]. It has a long vascular pedicle, so microvascular anastomosis can be performed outside the zone of injury [8,9]. The omentum is large, very thin and pliable, so it adjusts easily to irregular surfaces (such as a hand, foot or fingers) [1,2,8]. Besides, the omental flap can be contoured or tailored aggressively because of its reliable vascular anatomy [8,9].

Because of all mentioned special features and large surface the omental free flap was chosen as the best option to reconstruct degloving injuries in the cases presented. We found no information in the databases mentioned above that the omental flap was successfully used to reconstruct such extensive hand or foot tissue defects. Besides, both presented cases are unique because there was only partial soft tissue amputation in both of them. That is why a large and thin omental free flap was chosen and successfully transferred to the tissue defects in the cases presented. It is also very important to mention the fact that not only the amputation of the limbs was avoided, but also both patients preserved at least partial functions of the injured limbs. The good functional and aesthetic results confirm the fact that the omental free flap is an attractive option to cover very extensive degloved tissue defects.

The main disadvantage of using the omentum is the need to enter the abdominal cavity (usually by performing a laparotomy) to harvest the flap [1,2,5,8]. There are some reports suggesting that the incidence of donor site complications after harvesting the omentum can reach 18,5 % [10]. Yet a higher incidence was associated with poor general status and complicated systemic diseases of patients [10], so if a patient is in a good condition, there is a low possibility for complications associated with laparotomy. This can be illustrated by the two clinical cases presented in which there were no donor site complications, most likely addressable to the good general condition of both patients. The omental flap can also be harvested by performing a laparoscopy which is associated with less postoperative pain and donor site morbidity [8,9]. Another drawback of using the omentum is the difficulty of evaluating its size before harvesting [9]. It can cause problems if very large tissue defects need to be reconstructed and the omentum is not large

enough. However, there were no such problems in the cases presented, even though the tissue defects were very extensive. Besides, if there is a concern that the omentum can be not large enough, a laparoscopy can be performed and the size of the omentum evaluated before harvesting it [8,9].

5. Conclusions

A thin, very pliable, large and well vascularized free flap is needed to reconstruct degloving hand or foot injuries.

It is very hard to find the combination of all these features in a single flap. The presented clinical cases show that the omental free flap is an attractive option to cover degloved tissue defects. Its structural, anatomical and functional properties make it one of the best degloved tissue coverage solutions, especially when hand or foot injuries are large and extensive.

6. Statement of conflict of interest

The authors state no conflict of interest.

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