

Comparison of Sole to Palm Reconstruction Using the Combined Medial Plantar and Medial Pedis Free Flaps and Abdominal Pedicle Flap for Extensive Palm Injuries

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Abstract- The coverage of soft-tissue defects of the hand specially volar side needs special consideration. Although certain local flaps have been described and used for resurfacing the palm, Extensive injury requires distant or free flaps for coverage. abdominal pedicle flap has been traditionally used for extensive hand injuries, however there is no doubt that one of the ideal tissues for resurfacing the volar of hand is plantar tissue. We reconstructed the hand with a new procedure of combined medial plantar and medial pedis free flap, and compared it with 15 cases, whom their extensive palm injuries reconstructed with abdominal pedicle flap. The result was significantly better in respect to sensation, Texture of the Hand and patient satisfaction in compare of Abdominal flap.

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Key words: Surgical flaps; reconstructive surgical procedures; hand

Introduction

Reconstruction of soft tissue defects of the hand requires providing protective sensation and adequate texture and thickness of skin for normal function. Although certain local flaps have been described and used for resurfacing the hand, extensive injury requires distant or free flaps for coverage(1,2).

The specialized palmar dermal-epidermal histology and fibrous septal of subcutaneous layer give it a unique property to withstand the pressure and to absorb the shock of grasping in labour patient. We present a new procedure for reconstruction of palmar surface of the hand using the combined medial plantar and medialis pedis free flap for injuries that involves approximately whole of the palm including the thenar area and compared them with 15 cases of Abdominal pedicle flap.

Both the medial plantar and medialis pedis donor sites are well-known, and have been combined as a single free flap for reconstruction of the sole, but not for palm (3). The combined medial plantar and medialis

pedis chimeric free flap based on the posterior tibial – medial plantar artery and medial plantar nerve adds another dimension in resurfacing palm and thenar area for moderate to large sized defects.

Patients and Methods

We treated 3 patients who had extensive palm injury, with combined medial plantar and medialis pedis free flap, since September 2006 (group A), and compared then with 15 cases of extensive injuries whom were treated with Abdominal pedicle flap during that time in our center (group B). Two patients referred to our clinic because of severe flexion contracture and scar on the palmar and thenar area of their hands due to burn. Patients had undergone several operations for this problem and skin graft had been done for them. We excised the scar of the palmar area and tenolysis was done and in one case whose thumb IP joint had severe deformity, Artherodesis and pin fixation was done and because of Exposing of tendons and nerves, the defect in palmar and thenar areas covered with chimeric medial

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plantar and medial pedis free flap(4,6). The third case was a 22 y/o man who rushed to the emergency room because of a third – degree contact burn of the surface of his right palm. The defect before resurfacing consisted of exposed flexor tendons and neurovascular bundle of palm and thenar area, also in this case , we used chimeric medial plantar and medial pedis free flaps for coverage of the palm.

Surgical technique

Surgical technique of Abdominal free flap is very familiar for every hand surgeon. We explain the surgical technique of group A whom were treated with chimeric medial plantar and medial pedis free flap. With the patient in a supine position and lower leg in slight external rotation, ipsilateral combined medial plantar and medialis pedis flap based on posterior tibial – medial plantar artery were designed (4). The operative technique was a combination of two flaps: medial plantar and medialis pedis flaps under tourniquet control , the flap was raised from the nonweightbearing sole extending to the medial tuberosity of navicular bone (total size 10×10^{cm}) (Figure 1A)

The procedure began by raising the medial plantar flap in a distal – to – proximal manner followed by the medialis pedis flap(5). The distal part of the flap was dissected in a plane superficial to the abductor hallucis muscle, and the distal medial plantar artery and nerve were dissected (Figure 1B). The inter muscular septum between the abductor hallucis and flexor digitorum brevis was elevated with the flap. The medial plantar nerve was transected near the same level. The posterior tibial artery and nerve were isolated distal to the abductor hallucis muscle. On encountering the abductor hallucis, it was dissected distally and the division of the posterior tibial artery to the medial and lateral plantar arteries was noted. The medialis pedis flap was then elevated in a medial-to-lateral and distal-to-proximal manner. The plane of dissection was superficial to the periosteum of navicular bone. This flap includes the medial branch of the deep branch of medial plantar artery (Figure 1C).

The distal portion of posterior tibial artery was transected at the proper length required for reconstruction(Figure 1D). Radial artery was chosen as a recipient vessel, and was anastomosed in end –to- end manner. The abductor hallucis muscle was repaired after elevation, and a skin graft was performed over the donor site. The nerve was anastomosed in an end to end manner with the radial sensory nerve. The elevated flap covered the defect completely.

Physiotherapy began two weeks after resurfacing. The average follow up period was 20 months without any complication.

Results

In group A , all 3 patients were male and they ranged in age from 18-25 y/o in group B,9 patients were male and 6 patients were female. they ranged in age from 17- 30 y/o. They were observed from 6 months to 2 years (mean follow – up 20 month) after surgery. Evaluation after resurfacing consisted of two point discrimination, patient satisfaction, need to another operation ,duration of hospitalization (Table 1).

Patients satisfaction was estimated as aesthetic and functional satisfaction as excellent, good , fair, and bad. All Abdominal pedicle flaps required another operation for Isolating the pedicle and another operation for defating the flaps, duration of their hospitalization increased incompare to group A. Over all contoure , sensation, ability to endure shearing stress and palmar pressure (function) of group A were satisfactory and they had more satisfaction of aesthetic and function of their hand. Two point discrimination of them was approximately 10 – 12 mm which was within near normal limits at 8- 14 months. Partial necrosis of donor site graft was observed and treated conservatively in one case of them, however post operative outcome was uneventful. In the long term, paresthesia was observed in superficial surface of the skin from while the flap has been elevated in one of them, but the symptom was resolved approximately 6 months after surgery. No additional debulking procedure was necessary.

Table 1. Comparison of results in both groups

Group	Mean two point discrimination	Patient aesthetic	Satisfaction function	Number of operations	Duration of hospitalization
A	10-12 mm	Excellent	Good	1	4
B	> 15mm	Fair	Fair	3	13

Comparison of sole to palm reconstruction



A



B



C



D



E

Figure1. (A): The marking for combined medial planter and medialis pedis (to be used here as a free flap) (B),(C): The Chimeric flap is raised on its pedicles“ posterior tibial-medial plantar vascular system” (D): The chimeric flap has been transposed and sutured in palm (E): satisfactory overall contour of the resurfaced palm, and donor site are seen after 20 months.

Discussion

Injury of palm requires careful assessment and consideration of its unique anatomic properties. In labour patients it especially requires reconstruction that can withstand the pressure and shearing on manual work. Methods of reconstruction according to the degree and extent of the injury can vary from skin grafting to local flaps and free flaps (6). However skin grafts have a very limited application in reconstruction of defects with exposed tendon and nerve. Local flaps resurface palm but donor morbidity is not acceptable. Abdominal pedicle flap has been used traditionally for coverage of extensive hand coverage. But it has many complications and disadvantages such as necrosis, infection (7) and patient discomfort.

Pliable scapular facio cutaneous free flap can be used but other free flaps for palm defect don't match texture as naturally as those harvested from plantar or medial pedis free flap. However, special consideration in reconstructing the palm such as padding effect, restoration of sensation, and ability to withstand the force of shearing in labour patients, makes these flaps an ideal candidate for coverage (8). The use of such plantar or medial pedis skin is limited in nature. These conventional flaps provide a limited size for large defects of palm. So large extensive defects of the palm may require various combined flaps of a similar nature or various flaps using the chimeric principle. We designed flaps to reconstruct extensive defects of the palm by combining the medial plantar and the medial pedis flap based on the chimeric principle using the posterior tibial – medial plantar vascular system, thus maximizing the use of non-weight-bearing plantar skin. Our results were good in respect to sensation, texture, function of the hand and satisfaction of patients, in compare of Abdominal pedicle flap. We believe that this combined free flap could be a good alternative in

covering extensive palm injuries and as it is a new method, we suggest more researches to evaluate this method for extensive palm injuries coverage.

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