

The "EVE" Procedure - Vascularized Serratus and Rib Free Flap for First Metacarpal Reconstruction- A Case Report. Is it a Reliable Option for Metacarpal Bones Reconstruction?

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A 45-year-old right hand dominant male presented to our department with a circular saw trauma at his right hand, with complex bone and soft tissue defect of the first metacarpal ray (Figure 1a-1c) following a work related accident in 2015. During the trauma, the patient hit the ground and presented also symptoms of brachial plexus closed injury treated conservatory with good results. The patient was stable as his general condition was planned for the surgery of the thumb in the same night. Upon inspection of the traumatized hand, the soft tissue defect was about 6x8 cm, with complete avulsion and destruction of the first metacarpal, base of first phalanx, extensor pollicis longus (EPLT) and brevis tendon complete laceration and abductor pollicis longus disinsertion, laceration of the thenar and interosseous muscles. No neurovascular digital bundle lesion, the finger was warm, with good capillary refill. The wound was treated as first step with debridement, hemostasis and external bone fixator (Figure 1d and 1e), following 2 days postoperatively the reconstruction of the bone and the soft tissue defect with serratus anterior muscle and 9th rib composite free flap (Figure 2a-2d). The vascular supply was provided by thoracodorsal artery end-to-side anastomosis with the radial artery and collateral thoracodorsal vein end-to-end anastomosis with the

cephalic vein, were used as donor and recipient vessels (8-0 nylon suture Ethilon Ethicon) and for the osteosynthesis were used 2 "X" Kirschner (1.2 mm) wires implanted through first phalanx-rib-trapezium with functional arthrodesis (25° in flexion) of the interphalangeal joint of the thumb (Figure 2c). There was evidence of immediate perfusion after anastomosis. At 7 days postoperatively, the completely viable muscle flap was covered with split thickness skin graft harvested from the right thigh (Figure 2e). The patient was discharged one week after the reconstruction. Following 5 months, the patient was daycare-hospitalized again for the first step of EPLT reconstruction with Wright Medical Hunter Tendon Rod 2 mm x 24.5 attached by the remaining tendon distal and proximal heads with 4-0 nonabsorbable suture monofilament, followed by EPLT reconstruction with extensor digitorum longus tendon graft of the 2nd toe (in the absence of palmaris longus tendon) at around 6 weeks after the spacer's implantation - Pulvertaft technique (3-0 Assucryl Monoslow suture). The patient started active rehabilitation one week after the tenoplasty. At 6 months follow-up, there was evidence of good results, with 40% regained range of motion (ROM) in active flexion and extension of the thumb, good favorable functional prevention and no cold induced pain [1].

Figure 1a-1e: a-c: In the OR after first debridement; d, e: After external fixation of the remaining bone structure.

Figure 2a-2e: a- Serratus-rib flap marking, b- Serratus-rib flap harvested, c- Rib K-wires internal fixation, d- 24 hours postop viable serratus muscle, e- 24 hours postop serratus split thickness skin grafted.

Figure 3: a: Tendon spacer implantation, b-d: 6 months follow-up.

Successful rates and good ROM after metacarpal reconstruction with vascularized rib- serratus muscle flap and tendon reconstruction are mentioned in the medical literature. Guelinckx P and, Sin-sel NK [2] reported two cases of excellent rehabilitation of the first and second metacarpal reconstruction with composite serratus-rib free flap, with no donor site sequelae. K C Hui., *et al.* [3] found that no data are available on optimal rib level or harvest location and they harvested the sixth rib- serratus for the reconstruction. In our case, we used the ninth rib- serratus and both cases had no complications after harvest or long time sequelae of the donor site. In a study conducted by Georgescu and Ivan [4] on 7 patients who underwent metacarpal restoration with serratus-rib free flap, the success rate was 91.7%, only one flap presented venous thrombosis and was lost and all bones showed good osseointegration, which makes this vascularized composite tissue/flap a reliable and useful tool for small and curved bones' reconstruction with medium level of difficulty during the harvest.

The vascularized serratus- rib composite flap is a well-known but rarely utilized in the last years as bone structure for reconstruction of hand [5].

In conclusion, we present a case of successful first ray of hand microsurgical reconstruction of the metacarpal and soft tissue defect with a composite muscle-bone flap from serratus anterior-rib free transfer. Although the reconstruction principles were followed, this case presented its own set of unique challenges, including the composite flap chosen, the multiple step tendon reconstruction, the healing process and vicious scar formation- stiff joint and flexor tendon adhesions (IP) and the patient's own availability for active rehabilitation. We did not encounter any difficulties during the micro anastomoses and muscle and bone fixation or muscle skin grafting. The vascularized rib and muscle flap remains a good choice for small bones reconstruction, following the natural metacarpal shape and curvature. Provides excellent bone and muscle length for reconstructing the first metacarpal defect.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the authorship, and/or publication of this article.

Informed Consent

Informed consent for non-identifiable patient information and images to be published was provided by the patient.

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