

Customized reconstruction of complex soft tissue defects in the upper extremities with variants of double skin paddle ALT flaps

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Introduction

Complex soft tissue defect in upper extremity caused by machine injury and traffic accident is common, it usually has exposed important structures such as tendon, nerve, and bone, which make it difficult to repair. Local flaps featured by “like with like”, such as radial artery flap, and posterior interosseous perforator flap, are still useful reconstructive methods in the upper limb. But these flaps are restricted for large defects. Free flaps are good choices for large defects, it can repair the wounds with limited donor site morbidity. Lots of papers focused on using thin free flaps or superficial flap to cover the superficial wounds with good cosmetic results. However, these flaps may be limited in the complex upper extremity defects. For example, some wounds are wide, irregular, and non-adjacent which are not suitable for harvesting these flaps. Besides, if these large wounds combined with dead spaces, make it a challenge to repair.

To overcome these shortcomings, an algorithm was created to demonstrate the indications and the applications of these flaps for complex soft tissue in the upper extremities.

Objective

To achieve the customized reconstruction of the complex defects with good surgical outcomes and limited donor site morbidities, we shared our experience in using the variants of double skin paddle anterolateral thigh perforator (ALT) flaps.

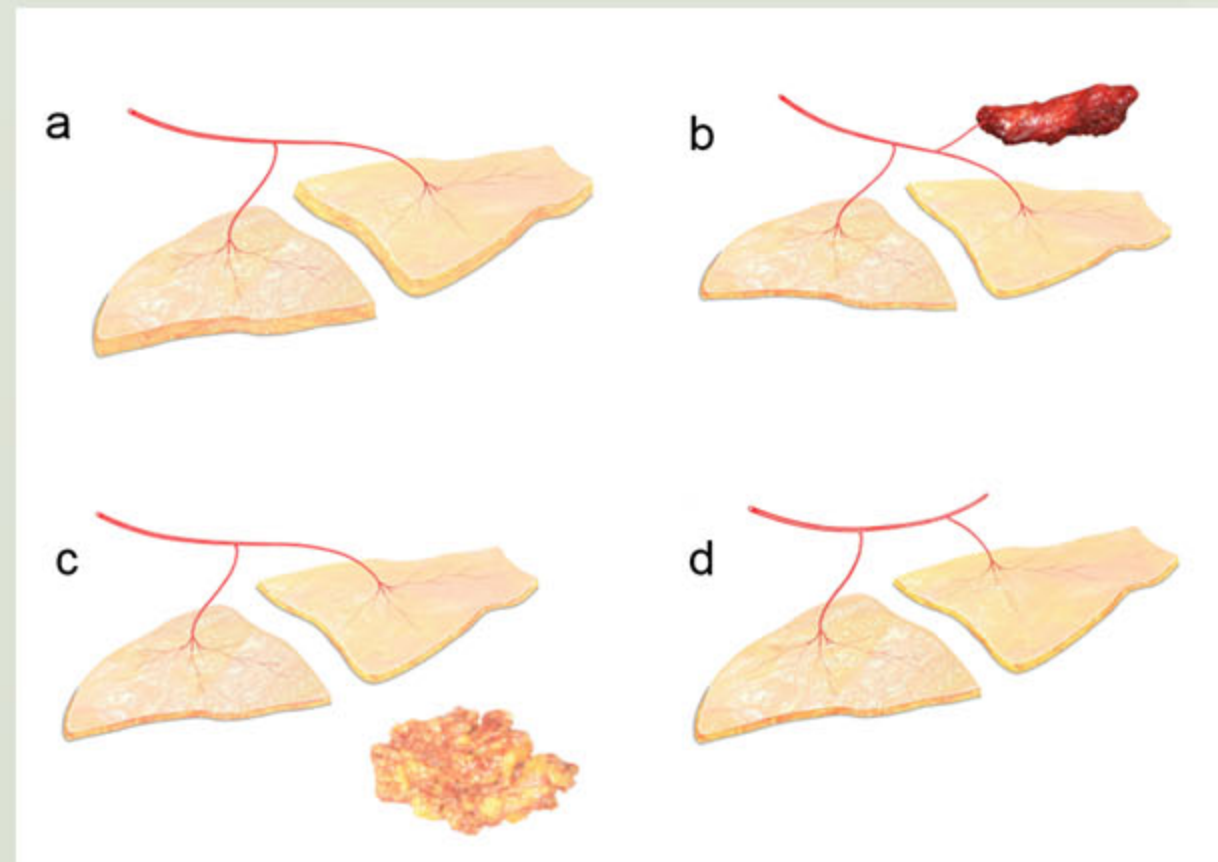


Figure 1. Schematic diagram of the variants of double skin paddle ALT flaps. (A) Classic double skin paddle ALT flaps; (B) Vastus lateralis muscle-chimeric double skin paddle ALT flaps; (C) Microdissected thin double skin paddle ALT flaps. (D) Flow-through double skin paddle ALT flaps

Patients and Methods

From January 2007 to December 2019, 15 patients (14 man and one woman) aged 15–61 years underwent double skin paddle ALT flaps reconstructions in the upper extremities. One wound is located in the elbow, four in the forearm, and 10 in the wrist or hand. All the wounds were large and non-adjacent defects with/without dead spaces. Four variants of double skin paddle anterolateral thigh perforator flaps were harvested according to the patient's needs.

Results

Fifteen patients were included in this series, these flaps included seven cases of classic double skin paddle ALT flaps, four cases of vastus lateralis muscle-chimeric double skin paddle ALT flaps, 2 cases of microdissected thin double skin paddle ALT flaps, and 2 cases of flow-through double skin paddle ALT flaps. One patient occurred flap necrosis because of pedicle kinking, all the other flaps survived without complications. The sizes of the skin flaps ranged from $6 \times 6 \text{ cm}^2$ to $26 \times 7 \text{ cm}^2$, and the sizes of the muscle segments ranged from $5 \times 2 \times 1 \text{ cm}^3$ to $16 \times 6 \times 2 \text{ cm}^3$. The follow-up ranged from 7 to 54 months, with a median of 15.6 months. Donor thigh morbidity was minimal. Most of the patients were satisfied with the cosmetic appearance. The mean value of the qDASH scores at the last follow-up was 27.12 ± 16.51 (range 11.4–59.1). None of the patients showed wrist flexion deformity. Three patients developed finger joint stiffness postoperatively because of severe injury.

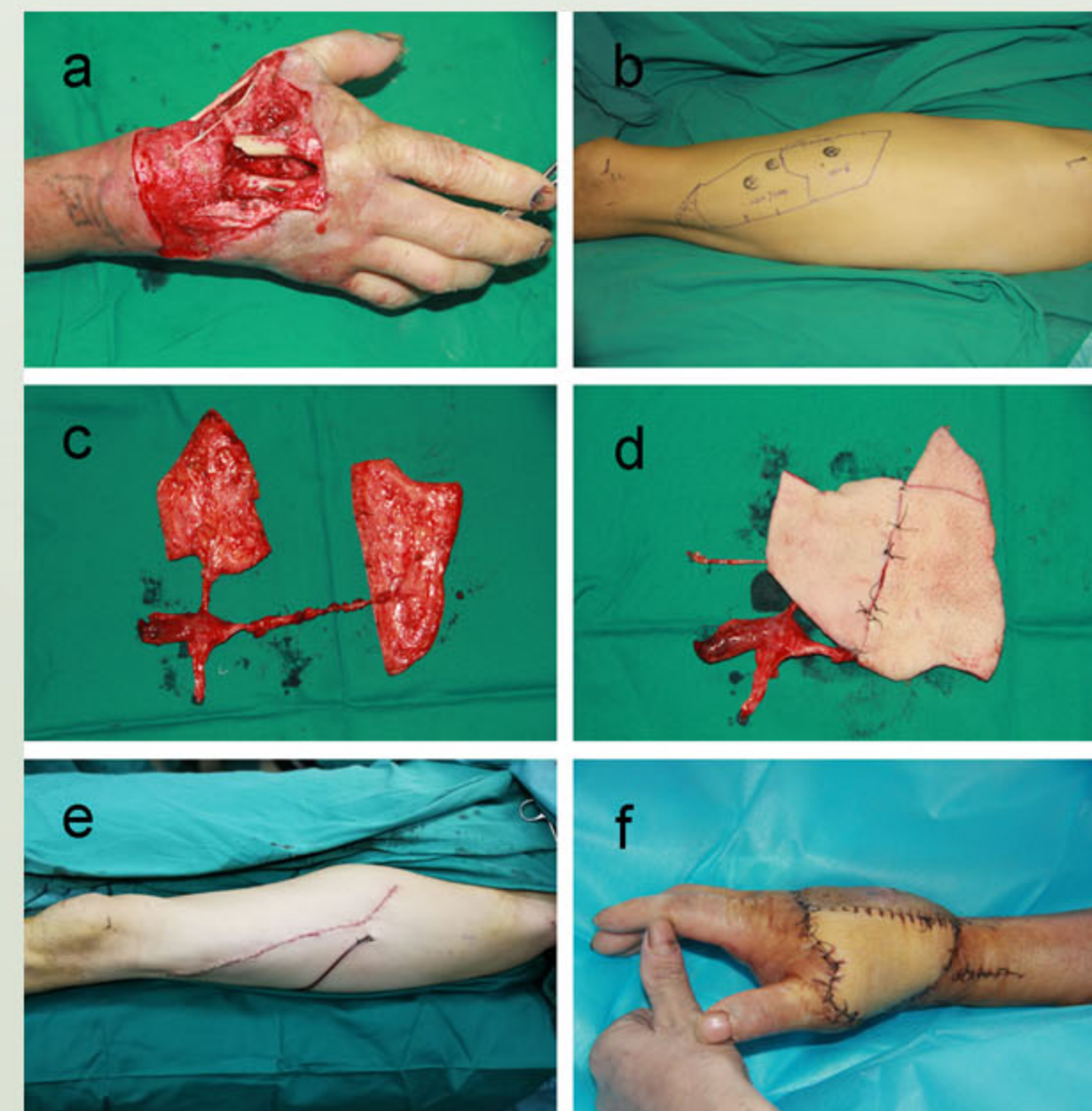


Figure 2. A 49-year-old man was injured by a machine that caused right hand large soft tissue defects combined with dead space. (A) Intraoperative view of the large wounds combined with dead space; (B) Design the VL muscle chimeric double skin paddle ALT flap; (C, D) Harvest of the VL muscle chimeric double skin paddle ALT flap; (E, F) Postoperative view of the donor and recipient site

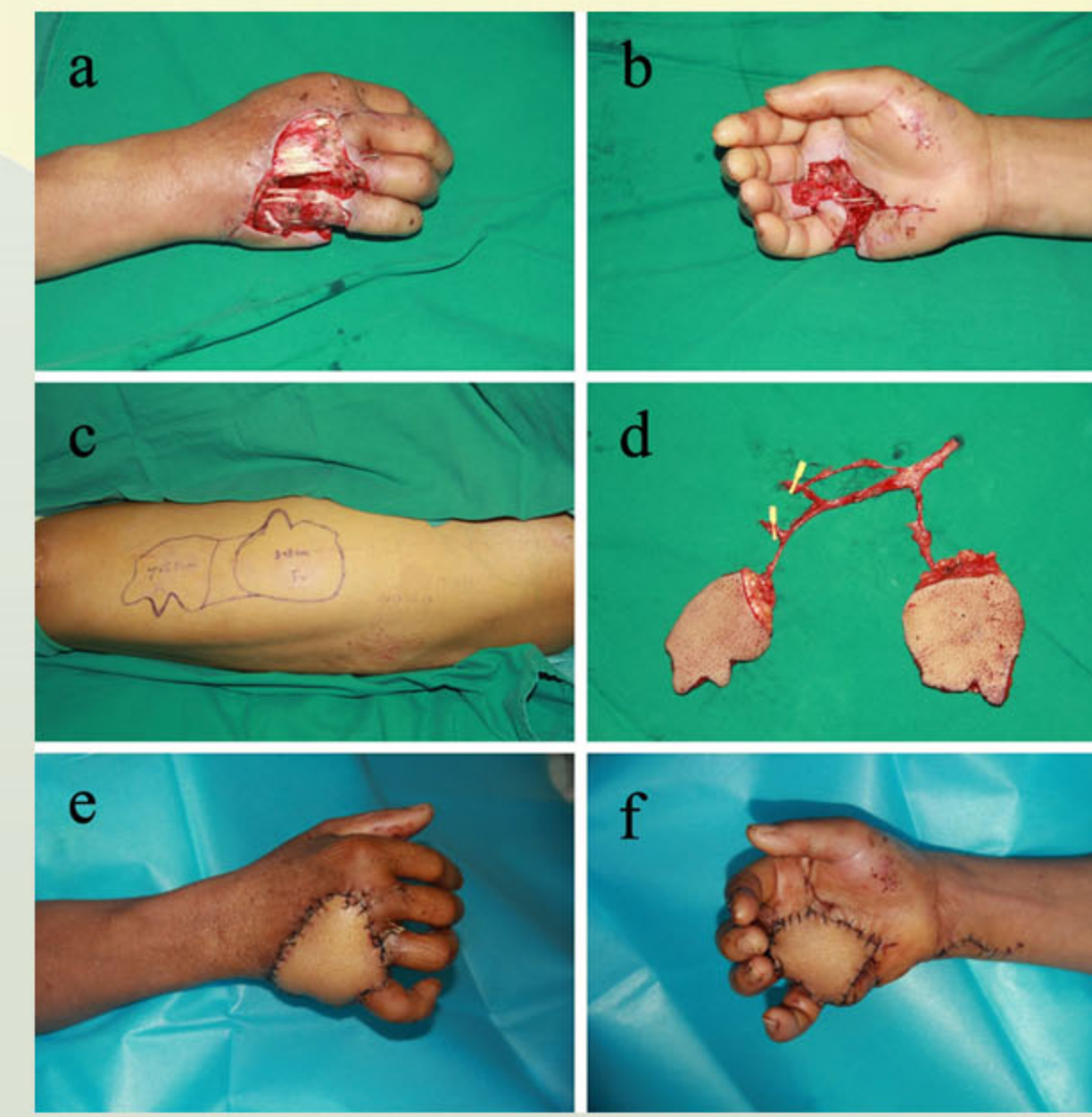


Figure 3. A 53-year-old man was injured by a machine that caused non-adjacent soft tissue defects in his right hand. (A, B) Intraoperative view of the nonadjacent wounds combined with the superficial palmar arch defect; (C) Design the double skin paddle ALT flaps; (D) Harvest the flow-through double skin paddle ALT flaps; (E, F) Repair the non-adjacent wounds and superficial palmar arch at one stage.

Discussion

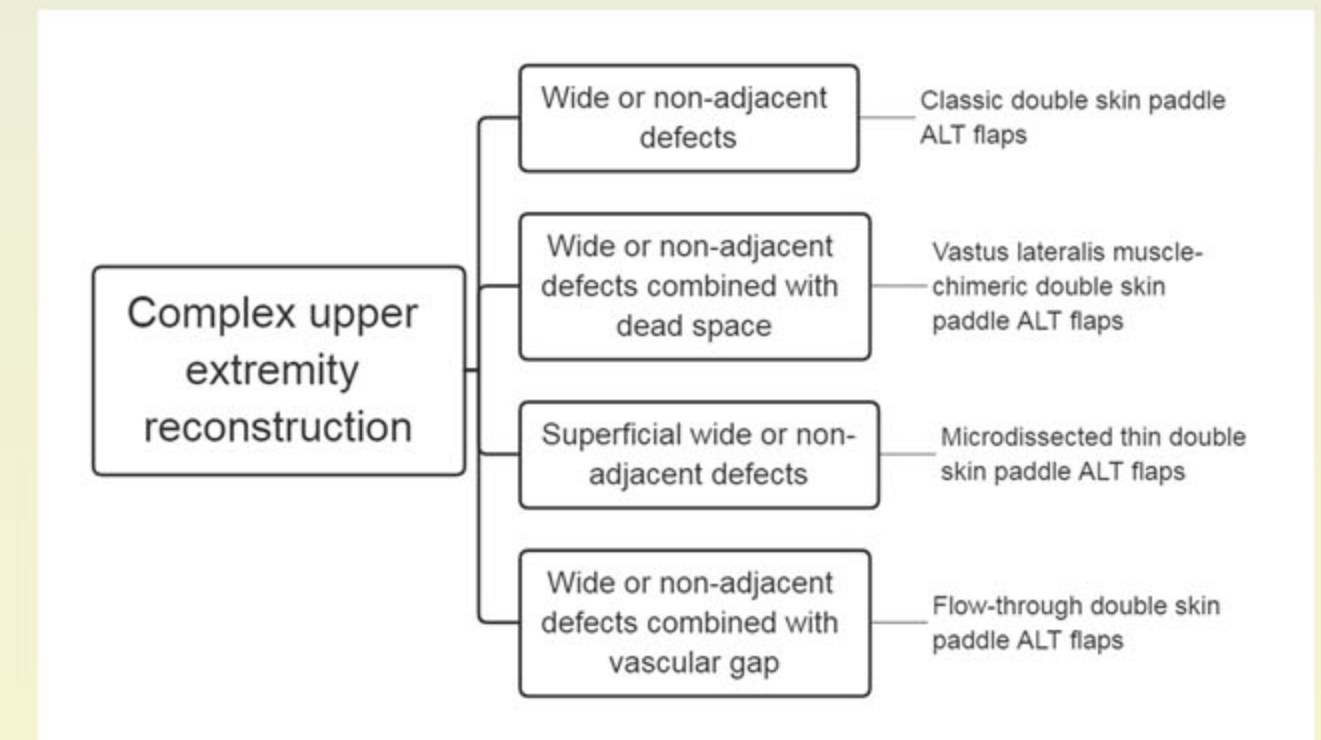


Figure 4. Algorithm for flap selection according to the characteristics of the complex wounds

Conclusions

Variants of double skin paddle ALT flaps provide versatile designs and allow customized reconstruction of complex soft tissue defects in the upper extremities with limited donor site morbidities.

References

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