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Comparison of perioperative complications of pedicled island flap in reconstruction of extremities

*Xu Gong, PhD, MD, Jianli Cui, PhD, MD, Ziping Jiang, MD, Suraj Maharjan, MD, Laijin Lu, PhD, MD, and Xiucun Li, MD**

Department of Hand and Foot Surgery, The First Hospital of Jilin University, Changchun, Jilin Province, China P.R.

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ABSTRACT

Purpose: The aim of this study was to analyze the differences in perioperative complications for pedicled island flaps in the reconstruction of extremities and to identify the factors contributing to pedicled island flap necrosis. Furthermore, the flap indications based on these outcomes are summarized.

Methods: Based on the inclusion criteria, 228 skin flaps were included in this study. Univariate and multivariate analyses were used to identify the risk factors for pedicled island flap necrosis. Differences in perioperative complications between upper and lower extremities were analyzed using the chi-square test or Fisher's exact test.

Results: The average age of the patients was 38 years. The overall complication rate was 21.93%, including partial flap necrosis (10.09%) and total flap necrosis (5.70%). The overall complication rate and flap necrosis rate in upper extremity reconstruction were significantly lower than the rates in lower extremity reconstruction. Flap area and postoperative wound infection were statistically significant risk factors for pedicled island flap necrosis in extremity reconstruction. Preoperative contamination of the wound bed was a statistically significant risk factor for postoperative wound infection.

Conclusions: The flap area and postoperative wound infection were both independent risk factors for pedicled island flap necrosis in extremity reconstruction. The causes contributing to the differences in perioperative complications between upper and lower extremities reconstruction included preoperative contamination of the wound bed, postoperative wound infection, and the flap area but were also related to anatomical factors of the skin flap. Pedicled island flaps are more suitable for small- and medium-sized soft tissue defects.

Introduction

Complex soft tissue defects caused by various types of trauma, tumors, or infections are not uncommon in extremities. Reconstruction of the soft tissue of the extremities poses a serious challenge in cases in which the bone, tendon, and neurovascular bundles are exposed and in cases with a paucity of local soft tissue. With the evolution of microsurgical techniques[1] and advancements in knowledge of cutaneous vascular anatomy,[2] the free flap has obtained great popularity for reconstructing the soft tissues of the extremities,[3,4] with a survival rate reaching 98.8%.[5]

However, the free flap has some disadvantages compared with the pedicled island flap, particularly the tedious and long operating time and the technically demanding nature of microvascular anastomosis.[6] Therefore, the pedicled island

* *Corresponding author*. Department of Hand and Foot Surgery, The First Hospital of Jilin University, No.71, Xinmin Street, Changchun, Jilin Province, 130021, China P.R. Tel.: +86-15904421798.
E-mail address: triumphlixc@163.com (X. Li).
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flap is still widely used to reconstruct defects in soft tissues of the extremities[7,8] due to the reconstructive principle of 'like-with-like'. The pedicled island flap also has its own drawbacks, including the limitation of the state of the tissues surrounding the tissue defect[9] and intentional twisting of the flap vascular pedicle. However, a flap pedicle rotation between 90° and 180° was previously shown to have no statistically significant effect on the pedicled island flap survival rate.[10-12] In addition, the overall complication rate of the pedicled flap was 17.1%-26.4%, including a partial flap necrosis rate of 6.5%-11.6% and complete flap necrosis of 2.7%-5.5%.[8,9,13-15]

Currently, the security and reliability of the pedicled island flap in the reconstruction of the soft tissues of the extremities have not been properly investigated. Based on present and previous studies using the pedicled island flap to reconstruct the soft tissues of the extremities, we proposed the following queries: does the use of the pedicled island flap show significant differences in the rates of upper and lower extremity complications? Which of the nontechnical factors affect the pedicled island flap necrosis rate in the reconstruction of the soft tissues of the extremities? What size of flap is safely perfused by the perforator artery?

Patients and methods

Data collection and grouping

The Institutional Review Board and Ethics Committee of the First Hospital of Jilin University approved this retrospective clinical study. The patient inclusion criteria were: (1) reconstruction of complex soft tissue defects of extremities using pedicled island flaps, (2) use of a pedicled island flap rotated between 90 and 180° in an extremity, and (3) use of a perforator artery or a known small-caliber artery as a vascular pedicle. We only investigated the initial pedicled island flap procedures and their perioperative complications. A detailed review of hospital records was performed. Accordingly, we enrolled 228 patients who underwent 228 skin flap surgeries from April 2010 to July 2015.

Preoperative patient-dependent characteristics, intraoperative records and postoperative wound infection (0 = no, 1 = yes) were collected and analyzed as the risk factors of flap necrosis. In addition, vascular compromise, subcutaneous hematoma, and wound dehiscence were also collected but not analyzed as the risk factors of flap necrosis, because vascular compromise is the process of flap necrosis, and subcutaneous hematoma and wound dehiscence are the both technical factors. Preoperative patient-dependent characteristics included age, sex (1 = male, 2 = female), smoker (0 = no, 1 = yes), hypertension (0 = no, 1 = yes), diabetes mellitus (0 = no, 1 = yes), mechanism of soft tissue defect (0 = nontrauma, 1 = trauma), osteomyelitis (0 = no, 1 = yes), preoperative contamination of the wound bed (0 = no, 1 = yes), soft tissue defect site (1 = upper extremity, 2 = lower extremity). Intraoperative records consisted of flap area, donor site closure (1 = primary closure [PC], 2 = skin graft [SG]), distally or proximally pedicled flap (1 = distally pedicled flap, 2 = proximally pedicled flap). The flap outcome was grouped into complete survival and necrosis (0 = complete survival, 1 = necrosis). Flap necrosis included partial necrosis and complete necrosis.

Patients with a history of cigarette smoking for more than 1 years were identified as smokers. Patients treated with oral antihypertensive medications for more than 1 week were considered to have a history of hypertension. Patients who required daily therapy using oral hypoglycemic medications and/or insulin were considered to have diabetes mellitus, and patients managing glucose levels with diet only were not identified as diabetes mellitus.[16] Preoperative contamination of the wound bed and postoperative wound infections were identified by cultivating the bacteria from wound secretions.[17] Flap necrosis of $\leq$60% was defined as partial necrosis, whereas flap necrosis of >60% was defined as complete necrosis.[18] In addition, flap viability was evaluated based on the flap color, capillary refill, tissue turgor, temperature, and pinprick test.

Statistical analysis

Age and flap area were continuous variables and were reported as means (ranges), and the remaining variables were binary categorical variables and were reported as frequencies or percentages. The data were analyzed using the Mann-Whitney U test for age and flap area and Fisher's exact test or the chi-square test for the categorical variables. The point estimates and 95% confidence intervals (CIs) of odds ratios (ORs) were calculated using univariate and multivariate logistic regression analyses. After the univariate analysis, the variables those were statistically significant or close to statistically significant were reanalyzed using a multivariate logistic regression model. The differences in perioperative complications between upper and lower extremities reconstruction were analyzed using the chi-square test or Fisher's exact test. A P-value < 0.05 was regarded as statistically significant. IBM SPSS 21.0 software (IBM Corp, Armonk, NY) was used to analyze all the data.

Results

Patients' characteristics

The average age of the patients at the time of surgery was 38 years (range, 1 to 83 years). One hundred eighty-three

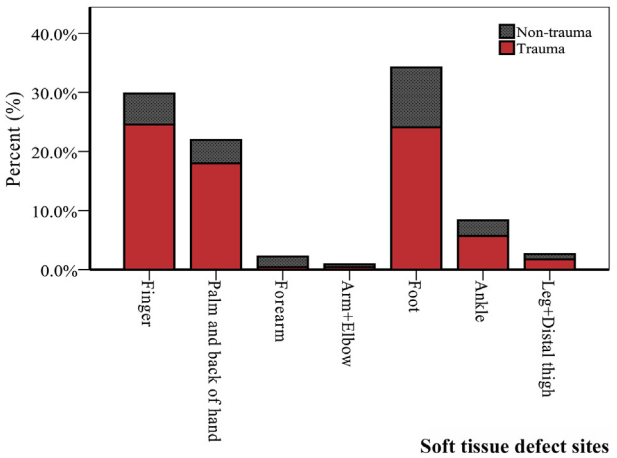

Fig. 1 – The anatomical locations of the soft tissue defects. (Color version of figure is available online.)