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Microsurgical reconstruction for post—traumatic defects of lower leg in the elderly: A comparative study

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ABSTRACTS

Background: Lower leg microsurgical reconstruction in the elderly is challenging, especially for post – traumatic defects. The present study aimed to evaluate the risk factors, management and outcome of free tissue transfer in patients older than 65 years of post-traumatic defects.
Methods: Retrospective chart review was performed for all patients older than 18 years undergoing free tissue transfer for post–traumatic lower leg reconstruction from April 2000 to November 2014. A comparative study was designed to identify risk factors and outcome.
Results: In total, 197 patients (ages 18–64) and 44 patients (ages $\geq$65, average 71.7 $\pm$ 6.3) were included and allocated into cohort 1 and 2, respectively. Cohort 2 had a higher rate of diabetes mellitus and/or peripheral artery disease (46.6%, $P < 0.01$). There was no significant difference in major flap complications, donor site complications and amputation rates ($P > 0.05$). A higher rate of intensive care unit (ICU) admission was observed in cohort 2 (37.8%, $P < 0.01$). Comparable limb salvage rates were recorded (97.1% and 95.6%, $P = 0.59$) with an average follow-up of 25.9 $\pm$ 30.1 months in cohort 1 and 23.7 $\pm$ 16.6 months in cohort 2.
Conclusion: Post-traumatic microsurgical free tissue transfer to the lower leg can be performed safely in patients older than 65 years with high success rate and manageable complications.

Introduction

Populations in most of the developed countries are continually becoming older. Logically, plastic surgeons will be faced more and more with defects requiring microsurgery in elderly patients, especially in the lower extremity.

Microsurgical reconstruction has been established as the gold standard for the treatment of complex soft tissue defects in the lower extremity [1]. However, its clinical employment in elderly patients is still a measure of risk stratification [2,3]. There is also an ongoing controversy, whether limb salvage after complex microsurgical reconstruction is resource – efficient and justifiable with regard to an increase or maintenance of quality of life [4]. Many factors must be considered in the planning of reconstruction, *e.g.* multiple general and microsurgery – related comorbidities, such as diabetes mellitus (DM) [5,6], age – related pathologies of peripheral nerves and arteries (PND/PAD) [7,8], and patient's ability to tolerate such extensive reconstructions [9].

There are only a few clinical studies on free tissue reconstruction in the elderly [3,10–22]. They demonstrated that advanced age is not a risk factor for free tissue transfer in the breast and head and neck regions. However, microsurgical reconstruction of post – traumatic lower extremity defects in the elderly seems to be more challenging with high rates of total flap loss [3]. There is still a lack of sufficient clinical data regarding lower extremity microsurgical reconstruction and the ongoing debate on limb salvage by free tissue transfer versus amputation and concomitant prosthetic fitting. In the present study, the aim was to evaluate the surgical outcome in post – traumatic complex lower extremity reconstruction in the elderly, while the lower leg was chosen as target region to achieve a high degree of statistical comparability.

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Patients and methods

Selection of study samples and patient characteristics

After approval of the local ethics committee (Mainz, Germany), all medical records of patients undergoing lower extremity reconstruction by free tissue transfer from April 2000 to November 2014 were identified in the lower extremity free flap database of our center. The protocol of this study was in accordance with the Declaration of Helsinki.

Patients who met the inclusion criteria were selected for further analyses: (a) post – traumatic soft tissue defect in the lower leg, (b) age of patient equal to or older than 18 years, (c) microvascular transfer of free autologous soft tissue flap as surgical technique, (d) complete medical records.

Clinical data extraction

The consecutive cases were divided into two cohorts based on the patient's age: cohort 1, aged 18 to 64 years and cohort 2, aged 65 years and over. The medical records of each patient were reviewed with data on age, sex, body mass index (BMI), smoking history, alcohol consuming history, diagnosis, etiology of defect, location of defect, microsurgically relevant comorbidities (DM and peripheral vascular disease), preoperative wound condition, history of negative – pressure wound therapy (NPWT), result of preoperative angiography, type of applied free flaps, length of operation, length of postoperative hospital stay, complications, and amputation. Follow-up data were obtained from medical chart review.

Perioperative therapies and surgical techniques

All patients received the same protocol of perioperative therapy and surgical technique. All microsurgical operations were performed as previously described [3,11,23]. Postoperatively, patients with advanced age or with increased procedural related comorbidities were admitted to the intensive care unit (ICU) for close overnight monitoring. General aspects of volume replacement, temperature monitoring *etc.* were performed.

Statistical analysis

Normally distributed continuous variables were presented with N, mean ± SD or N% and analyzed by Student's *t*-test. Categorical variables were compared using Chi^2 or Fisher's exact test. Bivariate regression analysis was used to check the odds ratio (OR) and 95% confidence interval (CI) between surgical outcomes and risk factors. All statistical analyses were 2 – sided end, $P < 0.05$ was considered significant. Statistical analyses were performed using SPSS 19.0 (SPSS Inc., Chicago, USA).

Results

Baseline information

A total of 241 patients were included in this study; cohort 1 (aged18 to 64) included 197 patients who were treated with 206 free tissue transfers, and cohort 2 (aged over 65) included 44 patients with 45 free tissue transfers. The average age of patients in cohort 1 was 44.6 ± 12.3 years and 71.7 ± 6.3 years in cohort 2, respectively. All defects were caused by trauma. Patients in cohort 2 had exceedingly more comorbidities than in cohort 1 ($P < 0.01$). More information is summarized in Table 1.

Preoperative wound condition and angiographic examinations

Exposure of important vital structures was observed in most wounds of both cohorts as the reason for free flap reconstruction (94.7% vs. 100.0%, respectively). The most frequently exposed anatomical structure was bone (71.3% vs. 68.9%, respectively), followed by osteosynthesis material (3.8% vs. 11.1%, respectively).

All cases of both cohorts received preoperative angiographic examination. Generally, the situation of arterial perfusion of the lower leg was comparable between two cohorts ($P = 0.56$). There were more cases with just one lower leg artery patent (8.9%) in cohort 2 than cohort 1 (4.8%), however the difference was not significant. Detailed information is summarized in Table 2.

Types of used free flaps

A total of 206 free tissue transfers were performed in cohort 1 and 45 in cohort 2, respectively. The anterior lateral thigh (ALT) flap was the most frequently used flap in both cohorts (n = 93 and n = 21, respectively), followed by the latissimus dorsi (LD) flap. More detailed information is summarized in Fig. 1.

Surgical outcome

In cohort 1, 144 free flap transfers (69.9%) healed without complications, which was statistically similar ($P = 0.87$) to that of cohort 2 (32 flaps, 71.1%). Postoperatively, significantly more patients of cohort 2 (37.8%) were treated in the ICU compared to cohort 1 ($P < 0.01$). Operating time and length of hospital stay were statistically similar between two cohorts ($P = 0.95$ and $P = 0.41$, respectively). In cohort 1, a limb salvage rate of 97.1% was achieved, which was statistically similar to that of cohort 2 (95.6%, $P = 0.59$). Two patient cases were shown in Fig. 2 and 3, respectively.

Table 1
Baseline information and characteristics of studied patients.

Characteristics	1 (≥18, <65)	2 (≥65)	P value
Total no. of free flaps	206	45	–
Total no. of patients	197	44	–
Sex, male,	169 (85.7%)	26 (59.1%)	<**0.01**
Age at first OP, years	44.6 ± 12.3	71.7 ± 6.3	<**0.01**
BMI, Kg/m^2	26.7 ± 4.7	28.1 ± 5.8	0.17
Smoking (per patient)	74 (37.5%)	4 (9.1%)	<**0.01**
Alcohol consuming (per patient)	77 (39.1%)	12 (27.2%)	0.14
Microsurgery related comorbidity (per flap)			
DM	17 (8.2%)	12 (26.7%)	<**0.01**
PAD	6 (2.9%)	6 (13.3%)	<**0.01**
DM + PAD	0 (0.0%)	3 (6.6%)	<**0.01**
None	183 (88.9%)	24 (53.4%)	<**0.01**

Values are described by N (%). OP: operation; BMI: body mass index; DM: diabetes mellitus; PAD: peripheral artery disease.

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