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Microvascular tissue transfers in the elderly: safety analysis for a challenging area

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Background/Aim: Due to increased average life expectancy, the number of elderly patients requiring complex reconstructive microsurgical procedures is rising. Age, comorbid conditions, and location of operation are all possible risk factors. The aim of this study is to evaluate surgical outcomes to set the right criteria.

Materials and methods: Between 1996 and 2014, the data of 30 patients over the age of 70, who were treated with microsurgical techniques in our clinic, were extracted from patient records and analyzed retrospectively.

Results: In this patient population, flap success rate was 94%. Systemic and surgical complication rates were 40% and 48%, respectively. Complication rates were higher in head and neck cases but there was no statistically significant difference compared to reconstructions in other areas. Loss of oral lining, as a serious complication, had no effect on complications in head and neck reconstruction patients in our series.

Conclusions: Flap success is comparable to younger age groups but procedures are associated with a high rate of complications Evaluating and controlling comorbid conditions is important. The American Society of Anesthesiologists scoring system is reliable in this patient population. Although complications are more common, these procedures can be performed safely in elderly populations with careful patient selection.

Key words: Elderly, free flap, microsurgery, complications, safety

1. Introduction

Now that we are in the fifth decade of free flap surgery, microvascular reconstruction has become an invaluable option among reconstructive methods. New techniques in microsurgery, shorter durations of operations, better handling of comorbid conditions by other practices, developments in anesthesiology, and better patient care in intensive care units (ICUs) all contributed to the widespread use of microsurgery. The adopted "reconstructive ladder" algorithm yielded a "reconstructive triangle" as the years passed. Nowadays the versatility of free flap use is not that burdensome on the patient's behalf.

The developments in medicine that gave rise to microsurgery also contributed to other disciplines. As a result of the advances in medicine, now the average human life is longer. Due to aging populations, now there are more elderly people than ever before who have conditions that need microsurgical interventions. Diminished functional capacities of these patients with or without diagnosed illnesses are discouraging for the microsurgeon. To date, many studies have been done on microsurgical procedures in geriatric populations. These studies did not oppose these operations. Instead, they mainly tried to set criteria for patient selection. The goal was to minimize morbidity and mortality by careful patient selection using the right criteria. Age, preoperative comorbid conditions, preoperative American Society of Anesthesiologists (ASA) and Charlson Comorbidity Index (CCI) scores, preoperative platelet count, duration of operation, and hospital and ICU stays were all investigated as risk factors in the past. Due to infrequent numbers of microsurgical procedures performed in this age group, many studies failed to state statistically significant data or found contradictory results.

Age was stated as an independent risk factor for morbidity in some studies (1–4), but others had opposite results (5–9). Preoperative comorbidities and tools for their assessment were also investigated. Many studies agreed that these conditions are risk factors for systemic complications, but some favored the ASA classification (4–6,8–10), some the CCI (3), and some the Kaplan Feinstein Index (KFI) (11), so there was no consensus on

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the method of assessment. Longer surgical duration's effect on complications and mortality is another area of debate (4,5,8).

There were also factors unstudied, like the location of surgery and oral disturbance. Head and neck reconstruction patients form a major part of this age group. The complication and mortality rates have never been compared with patients who had operations on other parts of the body. Among head and neck patients, disturbance of oral integrity has also never been investigated.

The aim of this study was to evaluate our own experience to set the right criteria for careful patient selection in the elderly population.

2. Materials and methods

The age cut-off to define patients as "elderly" is controversial in the literature. Many authors have mentioned that they chose the age cut-off arbitrarily (1,3,6,12–14). Coskunfirat et al. (5) took 70 as an age cut-off based on work (15) that suggested that postoperative complications increase after 70. According to the OECD, average life expectancy is similar in the United States and Turkey (16), so we also took 70 as our age cut-off.

Between 1996 and 2014, 30 patients over 70 who were operated on by using microsurgical techniques were extracted from patient records. Patient charts were reviewed retrospectively for demographics, risk factors, operative details, systemic/surgical complications, and mortality rates. Patients whose records did not include these elements and patients who could not be reached by phone for approval and follow-up were excluded.

The ASA scoring system was the dominant system used in the literature (2–6,8–10,12–14,17–20). Three studies calculated CCI scores (3,21,22) and only one study used the KFI (11). Therefore, the comorbidity-complication analysis of the review was based on the ASA scoring system.

Data extracted from our own records were analyzed using chi-square analysis.

3. Results

Details of the free flap of choice used for reconstruction among thirty patients are given in Table 1. A total of 32 flaps were transferred for 30 patients. Patients' ages ranged from 70 to 92. Mean age was 75 and mean ASA score was 1.96.

In our patients, total flap success rate was 94%. Systemic/surgical complication rates were 40% and 48%, respectively (Table 2), and the total complication rate was 73%.

Complication rates were compared between age groups and systemic/surgical complication rates were equal in patients both 70–80 years old and those over 80 years old (41% and 43%, P = 1). There was a correlation with preoperative ASA scores and both systemic and surgical complications. The systemic/surgical complication rate was 20% and 30% in ASA 1 patients, 46% and 38% in ASA 2 patients, and 62% and 62% in ASA 3 patients. Hence, this correlation showed no statistical significance (P = 0.163, >0.05, systemic; P = 0.361, >0.05, surgical), as shown in Figure 1.

Table 1. Number and percentages of different types of free flaps used in geriatric patients involved in the study.

	Operations (n = 32)
Radial forearm	7 (21.8%)
Iliac osteocutaneous	6 (18.8%)
ALT	5 (15.6%)
VRAM	5 (15.6%)
TFL	4 (12,5%)
Fibula, gracilis, SCIA, DIEP, LAD	1 each (3%)

ALT: Anterolateral thigh, VRAM: vertical rectus abdominis myocutaneous, TFL: tensor fasciae latae, SCIA: superficial circumflex iliac artery, DIEP: deep inferior epigastric perforator, LAD: latissimus dorsi.

Twenty-three (79%) of our patients were head and neck reconstruction cases. Complication rates were higher in the head and neck reconstruction group compared to other patients whose surgeries were performed in other body areas, but the complication rate difference was not statistically significant (79% vs. 42%, P = 0.153, >0.05), as shown in Figure 2.

Comparison of patients with or without oral integrity failure in the head and neck reconstruction group showed no statistical significance (71% vs. 88% respectively, P = 0.61), as shown in Figure 3.

We conducted ASA score/complication analysis for head and neck reconstruction patients separately. Systemic/surgical complication rates were 30% and 30% in ASA 1 patients, 67% and 55% in ASA 2 patients, and 83% and 67% in ASA 3 patients. We found a stronger correlation in this patient group with complication rates but it was statistically insignificant, as shown in Figure 4.

Mortality rate was 3.3% at 4 weeks of follow-up; however, it increased to 16.6% at 6 months.

4. Discussion

To date, free flap safety in the elderly has been investigated by many authors. The low number of microsurgical procedures performed in this age group limits many studies in stating statistically significant data. To assess the safety and success of these procedures, one needs to look

Table 2. Number and percentages of systemic and surgical complications among geriatric free flap patients involved in the study. Note that each complicated patient may have had more than one complication.

	ASA I	ASA II	ASA III	Patients (n = 30)
Systemic complications				12 (40%)
-Pneumonia	-	2	2	4 (13.3%)
-Sepsis	-	1	2	3 (10%)
-Arrhythmia	1	1	1	3 (10%)
-Acute Coronary Syndrome	-	-	2	2 (6.67%)
-Agitation	1	1		2 (6.67%)
-Other (PTE, SVT, pulmonary edema, CHF)	-	3	1	1 each (3.33%)
Surgical complications				14 (48%)
-Need for revisions	1	2	2	5 (16%)
-Total flap loss	1	-	1	2 (6%)
-Partial flap loss	1	1	-	2 (6%)
-Dehiscence	1	-	1	2 (6%)
-Surgical margin positivity	-	2	-	2 (6%)
-Carotid rupture, hematoma	2	-	-	1 each (3%)

PTE: Pulmonary thromboembolism, SVT: supraventricular tachycardia, CHF: chronic heart failure.

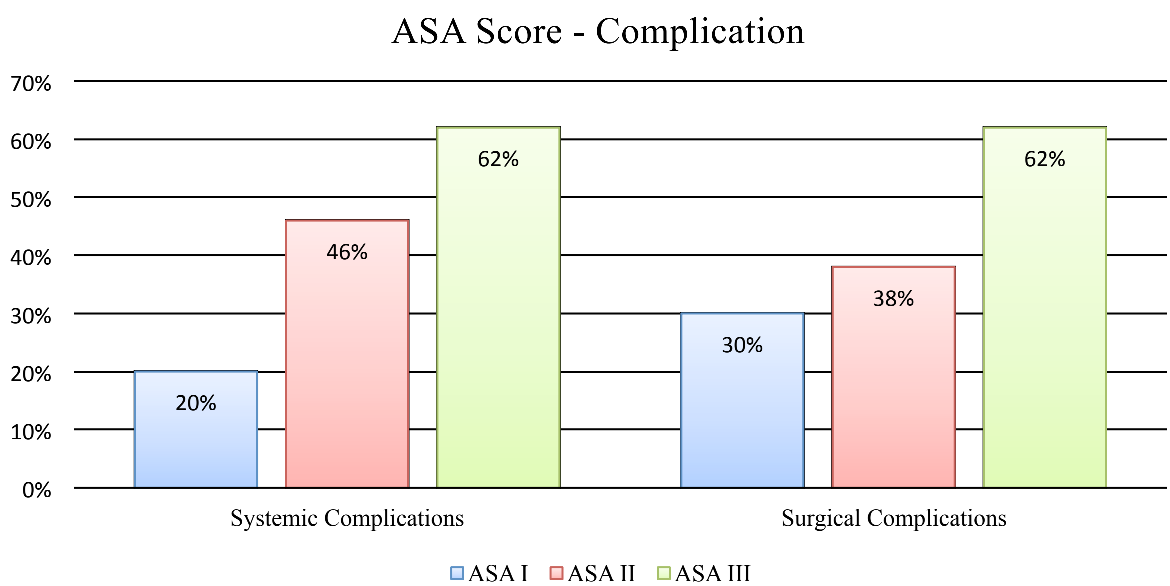

Figure 1. The relationship between preoperative ASA scores and systemic and surgical complications of geriatric free flap patients involved in the study. Numbers are shown in percentages. Although there was an increasing trend to develop complications while the ASA scores worsened, there was no statistically significant difference in complication groups (P = 0.163, P > 0.05 for systemic complication groups; P = 0.361, P > 0.05 for surgical complication groups).

at the success, complication, and mortality rates and their dependency on different variables.

On the basis of our patients, flap success rate is 94% among geriatric patients. In a patient survey comprising 2233 free-tissue transfers in all age groups, Shaw (23) reported a 93.3% overall success rate. Khouri (24) also reported 98.8% success in his own series comprising all kinds of free flaps in all age groups. Flap success rate in our geriatric series is comparable to that of younger populations.

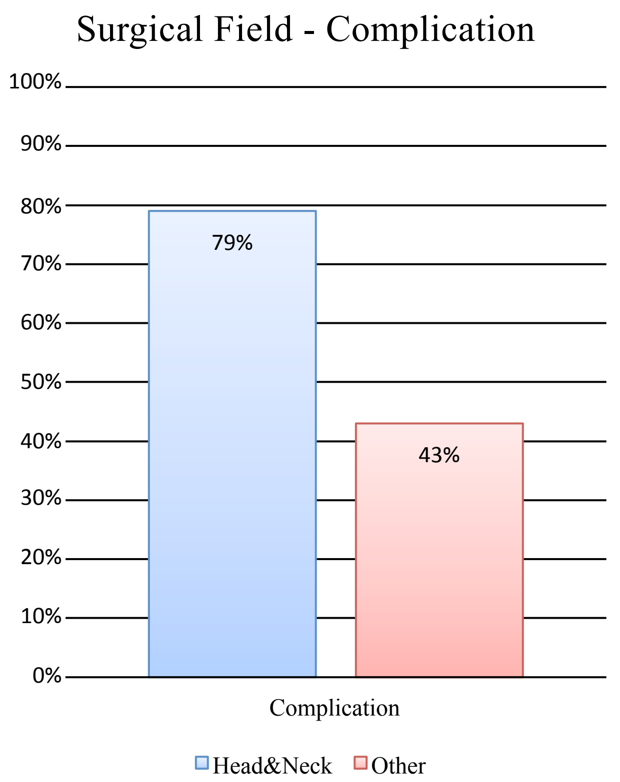

Figure 2. Percentages of all complications, systemic and surgical, in the head and neck region and other body areas. Complication rate difference was not statistically significant (79% vs. 42%, $P = 0.153$, $P > 0.05$), although the number of complications among head and neck reconstruction cases was higher, as expected.

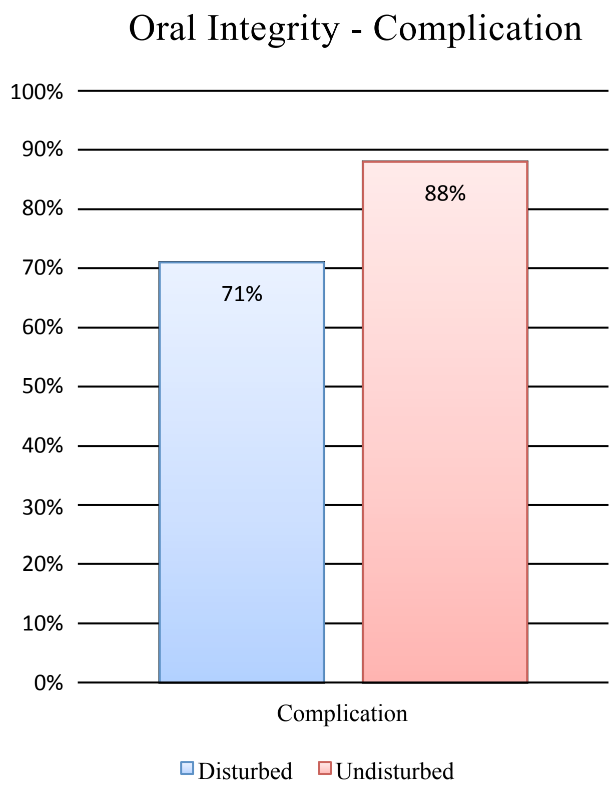

Figure 3. Percentages of all complications, systemic and surgical, related to oral integrity disturbance in the head and neck region. Complication rate difference was not statistically significant (71% vs. 88%, $P = 0.61$, $P > 0.05$).

Probable complications, both systemic and surgical, are discouraging for surgeons in this age group. Advanced age brings altered physiological capacity, especially in the cardiovascular system, and it is believed that these patients are prone to systemic complications under stressful conditions. Our systemic complication rate was 40%. These mainly involve pneumonia, sepsis, arrhythmias, acute coronary syndrome, and agitation because of electrolyte imbalances or other causes.

Altered wound healing capacity may also lead to surgical complications. Our surgical complication rate was 48%. In the early period, advanced age was investigated as an independent risk factor for microsurgery. Beausang et al. (1) and Howard et al. (3) classified age as a risk factor. However, many authors claimed that age is not an independent risk factor; rather, it is associated with comorbidities that lead to complications (8,10,21). We found no difference between 70–80-year-old patients and those over 80 years old in terms of complications. It is thus impossible to state age as an independent risk factor based on our analysis.

The most frequent method used in the literature for assessing comorbidities is the ASA scoring system. ASA scores were calculated to assess patients' comorbidities and higher scores were found to be associated with complications, both systemic and surgical. Systemic complication rates for the groups were 20%, 46%, and 62% for ASA I, II, and III, respectively. Surgical complication rates for the groups were 30%, 38%, and 62% for ASA I, II, and III, respectively. A steadily rising complication trend towards increasing ASA scores can be seen, but statistically these data were insignificant. We also made the same analysis among head and neck reconstruction patients, and while the correlation was stronger, it was still insignificant. We think that we failed to state significant data due to low patient numbers.

Head and neck reconstructions are stressful procedures for patients for many reasons. They are long-lasting, unstandardized procedures. Most commonly they are required after T3–4 oral cavity tumor resections, in patients with smoking and alcohol consumption history that also contributes to comorbidities. They involve major fluid losses and fluid shifts because they may involve the oral cavity. The unstandardized nature of these procedures brings along long surgical durations, which puts an extra burden on patients. Fluid losses

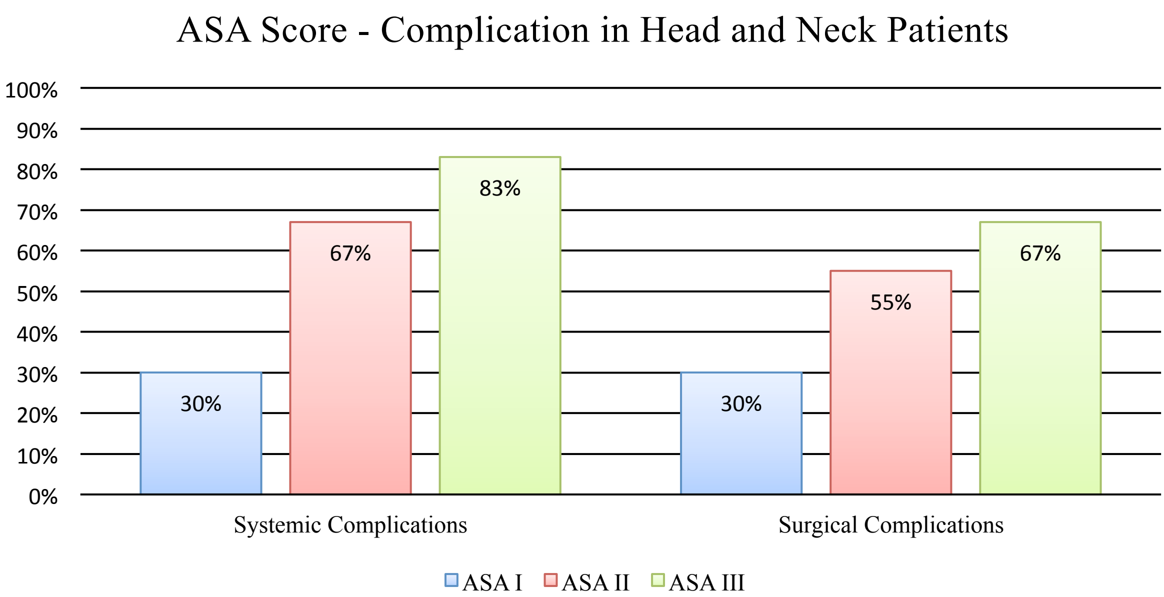

Figure 4. The relationship between preoperative ASA scores and systemic and surgical complications of free flaps to the head and neck region. Numbers are shown in percentages. Although there was an increasing trend to develop complications while the ASA scores worsened, there was no statistically significant difference in complication groups ($P = 0.074$, $P > 0.05$ for systemic complication groups; $P = 0.302$, $P > 0.05$ for surgical complication groups).

and immobility contribute stasis as in Virchow's triad, which may cause thromboembolic complications such as deep vein thrombosis or myocardial infarction. Systemic complication rates in our series were higher in head and neck reconstruction patients than other patients but this was statistically insignificant.

We wanted to compare patients in the head and neck group only, taking into account oral integrity as a parameter. We could not find any study that grouped patients accordingly, so we checked our own records. We assumed that a disruption in oral integrity may lead to major fluid losses, a compromise in the airway, salivary fistulae to the neck dissection area, and even exposure of the carotid artery to saliva or to the outside, with the latter condition perhaps resulting in a fatal outcome. Nevertheless, in our own data, we could not find any relation between oral integrity and complication rates (71% vs. 88%, respectively, $P = 0.61$).

We think that we failed to state significant data analyzing ASA classes and operation locations due to low patient numbers, although our sample size cannot be considered as small, knowing that the patients at that age who were operated on by using challenging microsurgical techniques were involved in the study.

Defining the time period for postoperative mortality plays a major role in elderly patients. Many articles limited their duration to 4 weeks postoperatively. Our mortality rate within this time limit is 3.3%. In the literature, only Blackwell et al.'s (2) and our study presented postoperative 6 month rates and they were 31% and 16.6%, respectively. This can be attributed to the comorbidities that these patients have, but we think that late complications and the recovery period after microsurgical procedures burden elderly patients more than younger ones.

Our study has its limitations. The retrospective method of the study is limited by the availability and content of medical records. We studied the patients who already had microsurgical procedures performed, but there is a major group of elderly patients who have been operated on by other conventional methods.

The latest advances in medicine increased the average life expectancy and nowadays the number of elderly patients requiring complex reconstructive microsurgical procedures is rising. Advanced patient age can be a discouraging factor for the microvascular surgeon who is already familiar with complications that may lead to morbidity and mortality. Age alone cannot be an independent risk factor but managing comorbidities is essential. ASA classification seems to be adequate in these situations. Head and neck reconstructions pose more difficulties than any other region. Flap success and mortality are comparable with those of younger patients but mortality increases when the follow-up period is extended. With preoperatively evaluated and controlled comorbidities and meticulous postoperative care, although complications are more common, especially in head and neck reconstruction, our analysis showed that these procedures can be performed safely in the elderly population.

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