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ORIGINAL ARTICLE

Outcome and complications of 540 microvascular free flaps: the Hamburg experience

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Abstract The aim of this study was to retrospectively analyze surgical outcome and complications of 540 free flap procedures performed at the Department of Oral and Maxillofacial Surgery of the University Medical Center Hamburg-Eppendorf during 1987–2005. A total of 532 patients were reconstructed with 540 flaps: 32% were latissimus dorsi flaps, 23% were radial forearm flaps, 21% were iliac crest flaps, 10% were fibula flaps, 6% were jejunal flaps, and 8% were other flaps. Thrombosis of one of the vessels and hematoma were the most frequent causes of failure in microvascular free tissue transfer. A total free flap failure occurred in 34 (6.2%) and a partial flap failure in 42 (7.7%) patients. The most reliable flap in regard to survival was the radial forearm flap. The present study confirms that free flaps are extremely reliable in achieving successful reconstruction of the head and neck.

Keywords Free flap · Microsurgical reconstruction · Head and neck defect · Outcome · Complications

Introduction

The use of microvascular free tissue transfer has allowed the reconstruction of complex defects in patients after head and neck cancer resections. There are a lot of clinical reports of free tissue flaps in soft and hard tissue repairs of various cancer ablation sites since the beginning of microvascular technique in the early 1960s [4–6, 8, 10, 12, 13, 15, 17, 19, 21]. Nowadays, microvascular surgery is a highly successful and relatively safe method for the reconstruction of head and neck defects, resulting in a low incidence of free flap failure and a high incidence of primary wound healing. The free tissue transfer has become a useful procedure that provides a great advance for head and neck reconstructions, while the standardized techniques have improved the results. Also, in elderly patients, microvascular free flap procedures can be safely performed, offering an improvement of quality of life despite the advanced age of the patient [2]. If special equipment, instrumentation, and expertise exist, free flap procedures can be performed with a high reliability rate. However, to balance risks and benefits of newly described modifications against the results obtained with established methods, a critical review of the so-far obtained results and their comparison with series published by other centers is of value.

Therefore, the aim of this study was to retrospectively analyze surgical outcome and complications of 540 free flap procedures performed at the Department of Oral and Maxillofacial Surgery of the University Medical Center Hamburg-Eppendorf during 1987–2005.

Patients and methods

Records of 532 patients (56% men and 44% women, ranging in age from 4 to 92 years) in whom 540 free flap procedures for reconstruction of defects in the head and neck region were performed during the years 1987–2005 were retrospectively analyzed. The medical records were reviewed and the details of the primary tumor site, flap

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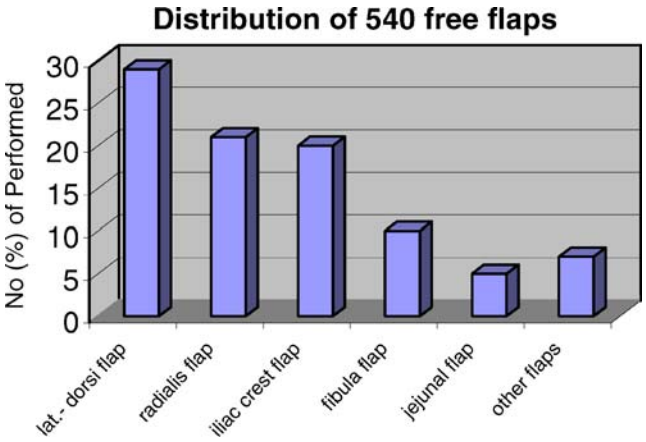

Fig. 1 Distribution of 540 free flaps used for head and neck reconstruction in 532 patients at the Department of Oral and Maxillofacial Surgery, University Medical Center Hamburg-Eppendorf, Germany from 1987 to 2005

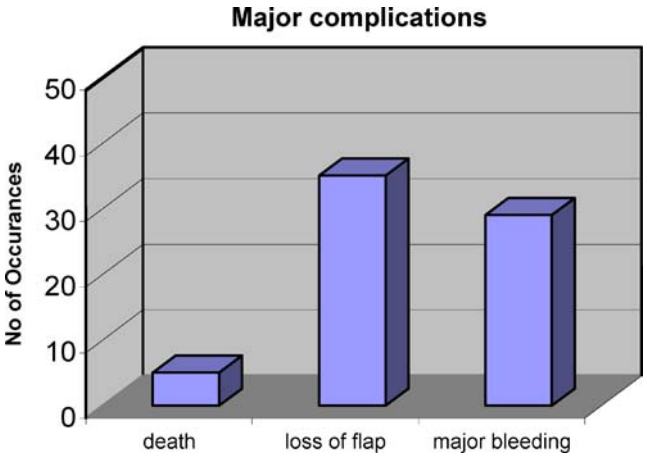

Fig. 2 Major complications in 540 free flap procedures

type, outcome, and complications were analyzed. The free flaps selected for reconstruction are listed in Fig. 1. Seventy-eight percent of the defects arose after the treatment of malignant neoplasms of the oral cavity. Twelve percent of the defects resulted from the resection of mid- or upper-face and skull-base tumors and another 10% from that of hypopharyngo-esophageal tumors. Thirty-five percent of the reconstructions were done in patients after radiotherapy. Primary reconstructions were performed in cases with benign diagnoses (26 patients), whereas secondary reconstruction was the therapeutic strategy in malignant diseases (452 patients). Reconstructions not related directly to tumor reconstruction, like the therapy for osteoradionecrosis, were realized in 54 patients.

Results

In the present clinical series, the average age of the patients was 53 years, with a range of 4–92 years. The primary site of the tumor was the oral cavity in 437 patients (82%), the mid- or upper-face and skull base in 70 patients (13%), and the hypopharynx or esophagus in 25 patients (5%). A total of 532 patients had reconstructions, with 540 flaps: 32% were latissimus dorsi flaps, 23% were radial forearm flaps, 21% were iliac crest flaps, 10% were fibula flaps, 6% were jejunal flaps, and 8% were other flaps (Fig. 1).

The complications after mircosurgery were divided into major and minor complications. Major complications involved 5 deaths (0.9%), 35 total flap losses (6.2%), and 29 major bleedings (5.3%) (Fig. 2).

Thrombosis of one of the vessels (8.6% arterial, 6.6% venous) and major bleeding (5.3%) were the most frequent causes of failure in mircovascular free tissue transfer. Minor complications included 42 partial flap failures (7.7%) and 31 cervical heamatomas (5.8%). A new flap was performed in 32 (5.9%) cases. In the other cases with flap necrosis, a secondary healing took place. New anastomosis of the vessels had to be performed in 22 (4%) cases in the early postoperative period. Fifteen flaps could be salvaged. The most reliable flap in regard to survival was the radial forearm flap (total flap failure in only 3.2% of the cases). The latissimus dorsi flap and the iliac crest flap failed in 8.4 and 12% of the cases, respectively. The length of intensive care unit stay was 3.4 days, and the total stay in the hospital was 38 days. As an example of successful reconstruction and functional rehabilitation, the case of a 52-year-old patient suffering from a subtotal loss of the mandible because of osteomyelitis is shown in Fig. 3.

Discussion

This retrospective review of 532 patients who had reconstructive surgery using free flaps after radical ablative cancer surgery in the head and neck shows a success rate of 92.3%, which is in approximate agreement with other series with success rates exceeding 90% [4–6, 9, 10, 12, 13, 15, 17]. However, the guarantees for such an outcome are experienced single surgeons [9] that are surrounded by teams that are used to treat patients with free flaps pre-, intra-, and postoperatively. Therefore, in high-volume centers, free flaps are increasingly offered to patients that would not have been considered for microsurgical procedures in earlier times [2, 9]. Furthermore, contrary to those cases in the beginning of this series, when pedicled flaps were used in cases needing re-reconstruction, these patients increasingly underwent second free flap procedures in cases towards the end of this series.

As in other series [4, 8, 11, 21], the radial forearm flap was the most commonly used flap type. It is most

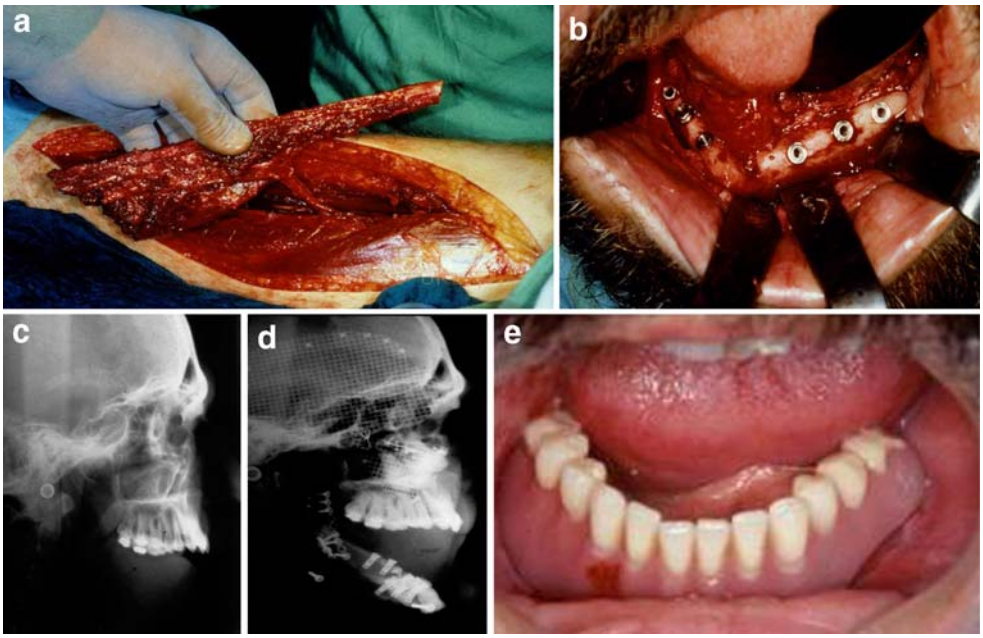

Fig. 3 **a** Harvesting the fibula flap via a medial approach. **b** Insertion of the bone flap with simultaneous placement of six implants. **c** Preoperative lateral radiograph. **d** Postoperative lateral radiograph demonstrating the achieved chin projection. **e** Successful functional rehabilitation

commonly used for the treatment of intraoral defects. Macnamara et al. [8] reported this flap type to have the best functional and esthetical outcome in their series of 60 patients receiving microvascular free flap transfer to the head and neck region. The total flap failure of this flap type in the here-described study was 3.2%, which compares well with 7% of other series [4, 14–16, 18]. The radial forearm flap has the quality of being highly vascular; thus having a beneficial role in wound healing [3]. The free latissimus dorsi myocutaneous flap has proved to be the most useful flap type for reconstruction of larger defects where voluminous tissue transfer is needed [4]. Therefore, the latissimus dorsi musculocutaneous flap was used in the majority of the patients of our series with tumor involvement of the upper midface and the skull base, and it was found to be ideal in filling these vast defects. In general, it is possible to reconstruct most defects of the head and neck with a limited number of donor sites. Therefore, the focus is nowadays not on an increase in more different flaps but on individualizing the flaps harvested from donor sites that the surgical team has experience with. The therapeutic goal is not just filling a defect, but the functional rehabilitation of the patient. However, for an even better functional outcome, surgical modifications, although doable from a technical point of view, are not always necessary, as we have shown before for the sensory recovery with or without performed nerve reconstruction [20].

Conclusion

As the here-described results support, in centers performing a high volume of tissue transfer with microvascular anastomosis, these procedure can be safely done. That means that, on the one hand, the surgical technique and the perioperative management have reached a high level of reliability, although most aspects are not evidence-based [1]. On the other hand, the consequences of failure are devastating for the individual patient, resulting in the demand of further advancement of applied techniques [7].

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