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Tissue transplantation in face reconstruction

C. Giuglea[1], I.P. Florescu[2], S. Marinescu[2], I. Lascar[3]

[1]Plastic and Reconstructive Surgery Department, Clinical Emergency Hospital" St John", Bucharest, Romania
[2]Plastic and Reconstructive Clinic, Clinical Emergency Hospital "Bagdasar-Arseni", Bucharest, Romania
[3]Plastic and Reconstructive Clinic, Clinical Emergency Hospital Bucharest, Romania

Rezumat

Transplantul tisular în reconstrucția feței

Introducere: La nivelul feței, transplantul de țesuturi este una din principalele metode reconstructive chirurgicale, care se folosește în general atunci când au fost epuizate rezervele locale sau locoregionale. Pentru reconstrucția diferitelor unități faciale afectate posttraumatic sau după largi rezecții oncologice, se pot folosi variate metode, adaptate dimensiunilor, naturii defectului, sau localizării acestuia. În cazurile cu defecte extensive sau sechele mutilante, transplantul de față ar putea fi o opțiune reconstructivă demnă de luat în considerare, în ciuda dezavantajelor acesteia.
Material și metodă: Lucrarea de față prezintă un studiu retrospectiv al cazurilor operate în perioada 2004-2010 în Clinica de Chirurgie Plastică și Microchirurgie Reconstructivă a Spitalului Clinic de Urgență "Bagdasar-Arseni", București, cazuri care au necesitat reconstrucții folosind diferite metode de transplant tisular.
Rezultate: Evaluarea cazurilor a arătat că rezultatele postoperatorii au fost bune și foarte bune. Pentru această evaluare, s-a ținut cont atât de gravitatea cazurilor cât și de riscurile operatorii, pentru fiecare metodă reconstructivă în parte.
Concluzii: Transplantul de țesuturi la nivelul feței reprezintă piatra de hotar în reconstrucția regiunii, și în același timp o etapă preliminară în transplantul de față, atunci când acesta poate avea indicație.

Cuvinte cheie: reconstrucția facială, transfer de țesuturi

Abstract

Introduction: At face level, tissue transplantation is one of the main methods in reconstructive surgery, generally used when local and locoregional reserves are outworked. To reconstruct different face units after trauma or oncologic resection we use different methods, according to dimensions, nature and site of the defect. In cases with extensive defects or mutilating sequelas, face transplantation can be a reconstructive option that should be taken in account, despite its desavantages.
Matherial and method: In this paper we present a retrospective study of the cases we operated during 2004-2010, in our Plastic and Reconstructive Surgery Clinic of Clinical Emergency Hospital "Bagdasar-Arseni" which needed reconstructions with different tissue transplantation methods.
Results: Case evaluation showed that postoperative results were good and very good. For this evaluation, we took in account both case gravity and operative risks, for each reconstructive method.
Conclusions: Tissue transplantation for face reconstruction represents the latest milestone in face reconstruction, as well as a preliminary stage for face transplantation, when there is right indication.

Key words: face reconstruction, tissue transfer

Corresponding author: Carmen Giuglea MD
Plastic and Reconstructive Surgery Department
Clinical Emergency Hospital" St John", Bucharest
E-mail: giugleacarmen@yahoo.com

Introduction

History of free tissue transfer begins in the early 1960s, when Malt, Mc Khann and Chen et al. performed the first successful replantation of an amputated arm and hand, restoring the circulation to human tissue parts through the repair of small vessels. In 1965 Kleinert and Kasdan reported the first digital revascularization(1), and Cobbett in 1969 reported the first toe to thumb transfer.(2).

In the same period of time the concept of axial pattern flaps with identifiable supplying vessels was developed by Bakamjian, Mc Gregor and Morgan, thus setting the stage for the free transfer of skin flaps (3). After transplantation of a groin flap, omental flap to cover defects of the scalp and lower extremity, new donor flaps appeared and large clinical series of free flaps, technical innovations and new applications quickly followed. Nowadays, microsurgical tissue transfer is an essential part of plastic and reconstructive surgery.

We can define a free flap as a composite block of tissue that is surgically removed from a donor site in the body and transferred in one stage to a distant recipient site where its circulation is restored via microvascular anastomoses (4).

Principles of free flap surgery and application in face reconstruction

Taking in account the great importance of the face when we plan a reconstruction at this level, functional, aesthetical, social and psychological impact must be always in our mind.

Etiology of the defects at this level can be posttraumatic or postexcision of tumors.

When we plan the reconstruction, we must think about the reconstructive scale (direct suture, skin graft, local and regional flaps, free flaps) and keep in mind that the simplest solution is always the best. Small defects in this region are best reconstructed with local tissue to achieve the closest color match. For larger defects distant tissue is usually required. Free flaps were initially used when regional flaps as pectoralis major or deltopectoral flaps were unsuitable or had failed, but as the experience with free flaps increased they were preferred for both difficult and routine reconstructions (4).

When a free flap is available and the possibility to perform it exists, the excision can be as large as needed from oncologic consideration, knowing that as much tissue as necessary can be removed to provide curative cancer operation without worrying about closure of the defect(4). During the extirpation and without interfering with the other team the microvascular surgeons can harvest the flap from a distant site and be prepared to begin the reconstruction immediately after tumor removal. These direct reconstructions can dramatically improve the patient's quality of life. At the face level there are also many recipient vessels that can be used for free tissue transplantation, even though irradiation or atherosclerotic disease can affect these vessels(5).

The advantages of free tissue transplantation are as follows: single-stage immediate total reconstruction; practically any defect as large, deep or complex is, can be covered through this method, these flaps being particularly important when restoring specific functions; the freedom of design meaning the ability to choose the proper tissue, donor site and orientation of the pedicle allows wider options in the design of the reconstruction for achieving optimal results; the ability to cover large defects that can be reconstructed only with a large free flap; the ability to reconstruct a large defect as a unit, with the possibility of replacing losses in kind, with a freedom of orientation and no bulky pedicle, leads to a good aesthetic result; independent blood supply allows them to be used in compromised wounds, irradiated beds and over large avascular areas such as bone or foreign bodies (6); reliable technique with more than 95% success rate (7).

As any other surgical technique, free tissue transplantation has also disadvantages, like long operative time, the necessity of a specialized operative team, higher operative risks because of the vessels condition, patient's age and associated illnesses, higher donor zone morbidity (8).

Very important for the success of the operation is a good surgical plan. It has three major steps: preoperative phase, operation and postoperative phase (9).

In the preoperative phase we should follow the next pattern; problem assessment, reconstructive goals and priorities, evaluate specific surgical considerations, plan the surgery, anticipate problems and alternative plans, rehearse the operation and educate the patient.

The operation should follow the next steps: coordination with the anesthesiologist, positioning the patient, dissection of the donor and recipient sites, determining the adequacy of the recipient vessels, dividing the donor vessels, temporarily insetting of the flap, performing the anastomosis, closing the donor site and checking the vascular pedicle and insetting the flap (10).

In the postoperative period is important to make a proper dressing, insure a systemic management, monitor flap circulation, reexplore if needed, and think of secondary procedures.

Matherial and Method

We present in this paper our experience in free tissue transplantation, with case examples, for face reconstruction in the last ten years and our results using this method. In the last years, we had to deal with all kinds of defects, after large oncologic excisions or posttraumatic. The cases with postexcisional defects were both after primary tumors and relapses of the tumor.

This paper includes a study on 21 patients with extensive tumors at the head and neck submitted and operated in the Plastic and Reconstructive Clinic of the Clinical Emergency Hospital "Bagdasar-Arseni", Bucharest, between 2004-2010.These cases had as particularities their localization, their high gravity due to the dimensions of the tumors and also to the reconstructive method needed for reconstruction, free flaps being the only choice.

For making a statistic analysis of these cases, we considered a few clinical and biological parameters as follows:

- patient's age and the repartition according to the

standard age group and also analysis of the extreme ages of the operated patients;
- gender repartition that shows a great majority of male patients;
- social environment of the patients;
- occupation and education;
- declared duration of the tumor;
- medical route of the patient and his prior treatments;
- histopathological type of the tumor;
- initial tumor localization.

We continue analysing one by one these parameters to demonstrate their importance in the discussed pathology.

Considering patients age, it predominated the age group of 40-60 years, representing a 68,75%; the rest of 31,25% being represented by 60-80 years group of age. This fact demonstrates the connection between the duration of exposure to different environmental factors with a role in cancer ethiology and the moment of apparition. This explains also why it appears in young patients only exceptionaly. *(Fig. 1)*

Considering patient's gender, we found a 12,5 percentage for female patients and 87,5 for males. We can reach to the conclusion that women pay more attention to skin lesions, expecially those on the face. That's why they address to the doctor sooner and don't get extensive tumors, unless they are ignorant or poor persons. *(Fig. 2)*

In their majority, the patients were from urban environment (81,25%), the rest (18,25%) being from the countryside. This fact is sort of contradictory because the last category are more exposed to sun than the other one, but in the same time, they don't go to see a doctor, so their numbers might be unreal. We should consider better the level of education, according to which the patients search for doctor help. *(Fig. 3)*

Considering the proffesion, we found the next results - *(Fig. 4)*.

It looks like been instructed people, but busy with all kind of activities in the end neglect their lesions, especially if they don't feel pain.

Other issue that should be analysed is the duration of the tumor and also the prior treatments. We can see that in 10 cases the tumor duration was 2-5 years, in 7 cases between 7-13 years and only in 4 cases over 25 years. The conclusion is that most of the patients had medium or high aggressive tumors with quick evolution in time. The melanoma was not included in our study, due to its gravity and malignancy, with fast evolution (11). *(Fig. 5)*

Finally, we can say that choosing the proper flap for reconstruction must be according to the size and complexity of the defect. We used three types of free flaps: radial forearm flap fasciocutaneous, latissimus dorsi musculocutaneous flap and fibular osteomiocutaneous flap. *(Table 1)*

For each case we took in account the size of the defect and also his complexity, his situation regarding to the facial aesthetic unit, the patient's age and his associated illnesses and choose the free flap to use according to these considerations. We'll present a few cases, the most representative ones.

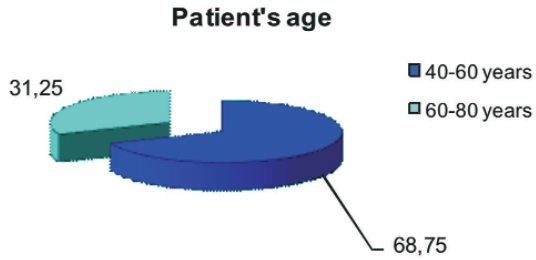

Figure 1. *Percent structure of study group for pacient's age*

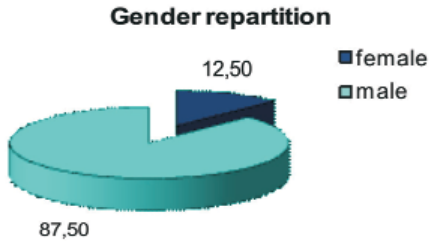

Figure 2. *Gender repartition in study group*

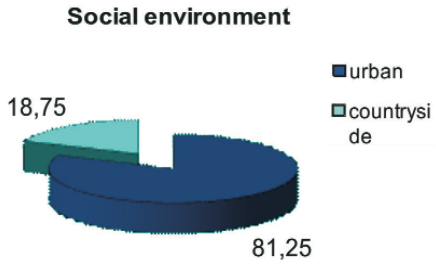

Figure 3. *Percent structure of study group for social environment*

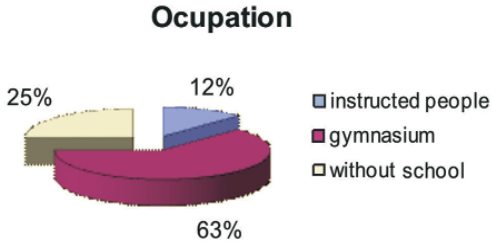

Figure 4. *Ocupation repartition in study group*

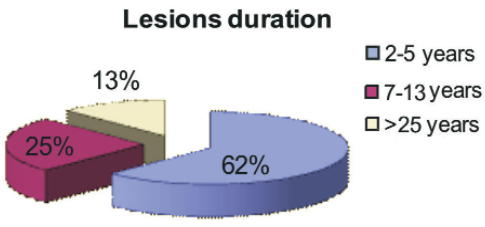

Figure 5. *Lesions duration repartition*

Table 1.

Reconstructive method	No of cases
Radial free flap	12
Latissimus dorsi free flap	7
Fibular free flap	2

Case examples

Case 1

Basal cell carcinoma of the left oculo-orbital region with invasion of the maxillary and ethmoidal sinuses. *(Fig. 6 A,B)*

The excision was large with radical intention - *(Fig. 6 C)*.

According to the size of the defect we choose for reconstruction a free musculocutaneous latissimus dorsi flap.

Intraoperative aspect and immediately after the operation - *(Fig. 6 D,E)*

At three months after the operation, with a perfectly integrated flap and a very good local evolution - *(Fig. 6 F,G)*

At four months after the operation after flap adjustment - *(Fig. 6 H,I)*

Figure 6. ***(A, B)*** *Preoperative aspects (Case 1)*

Case 2

Basal cell carcinoma of the fronto-temporal region and right auricle, with osteolisis of the frontal bone and exposure of the dura mater. *(Fig. 7 A,B)*

We performed large excision of both affected areas sacrificing the right auricle and external ear but with conservation of the tympanum [9]. *(Fig. 7 C,D)*

We used for cover a free fasciocutaneous radial flap for the frontal defect and a muscular temporal flap skin grafted for the external ear defect. *(Fig. 7 E,F)*

Postoperative aspect at two months - *(Fig. 7 G,H)*.

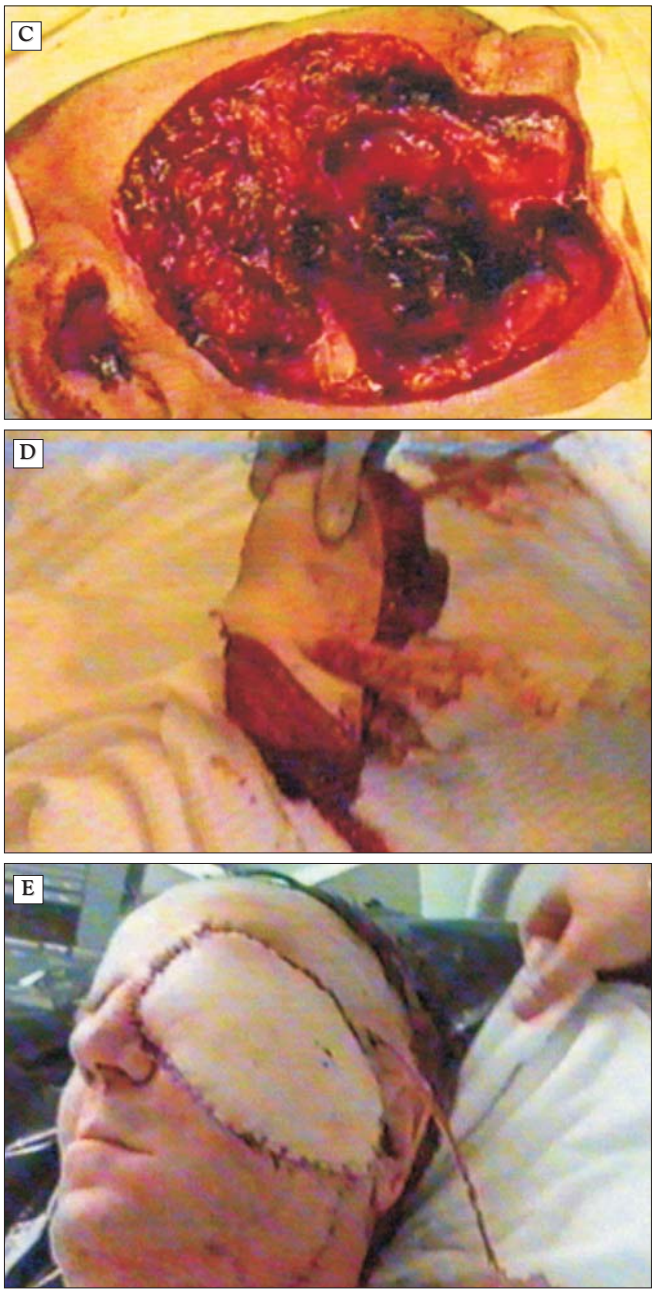

Figure 6. ***(C)*** *Intraoperative aspect – defect after large excision* ***(D)*** *Intraoperative aspect – free latissimus dorsi flap harvested.* ***(E)*** *Immediate postoperative aspect*

Figure 6. ***(F, G)*** *Postoperative aspects after 3 months.* ***(H, I)*** *Postoperative aspects after 4 months, after flap adjustement*

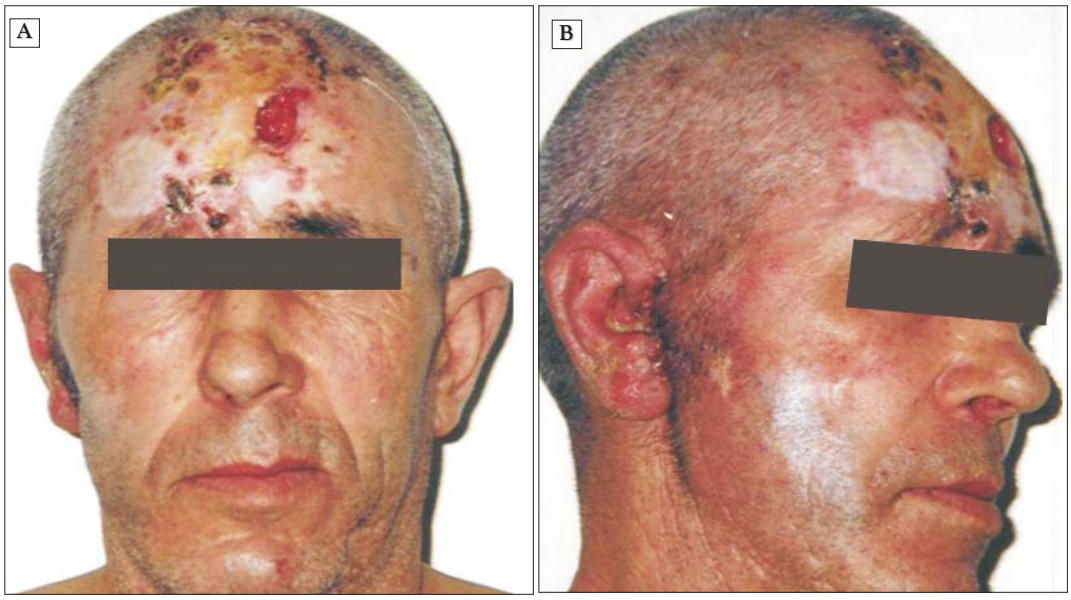

Figure 7. ***(A, B)*** *Preoperative aspects (Case 2)*

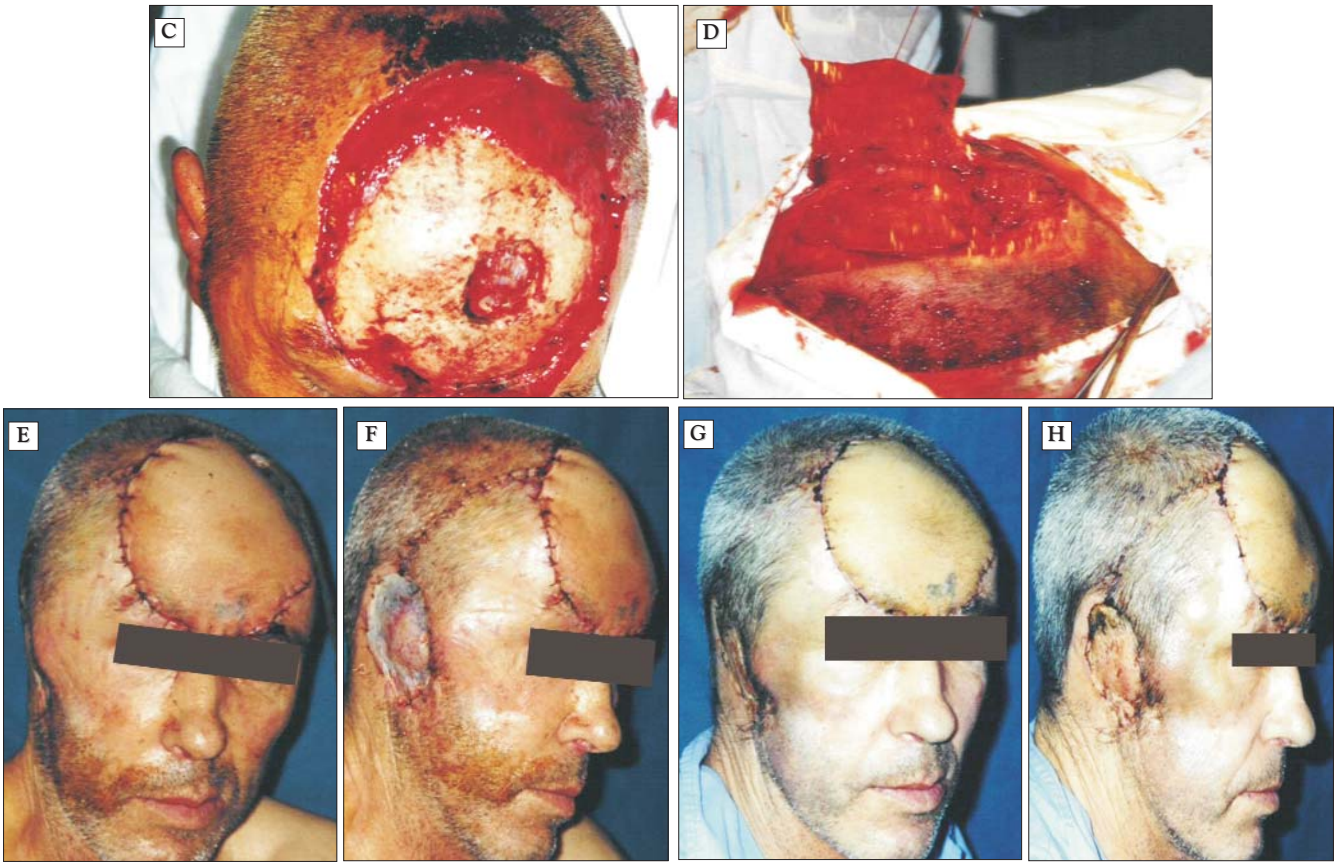

Figure 7. ***(C, D)*** *Intraoperative aspects (frontal defect, temporal flap).* ***(E, F)*** *Early postoperative aspects.* ***(G, H)*** *Late postoperative aspects (after 2 months)*

Case 3

Basal cell carcinoma originating from upper lip with invasion of the right nasal wing, cheek and maxillary sinus. *(Fig. 8 A,B)*

Intraoperative images: Covering the defect with a free fasciocutaneous radial flap, covered on its deep surface with grafts: the grafts were sutured on the inner part of the flap in its inferior half and reflected on the dental arch of the right maxillary (for oral mucosa reconstruction).

We excised on the cutaneous surface of the flap, the epidermis, in two areas where we reinserted the right nasal wing and columella - *(Fig. 8 C,D,E,F)*

Postoperative evolution was good. Aspect at ten days. *(Fig. 8 G,H)*

Aspect at one year, with no signs of relapse - *Fig. 8 I,J.*

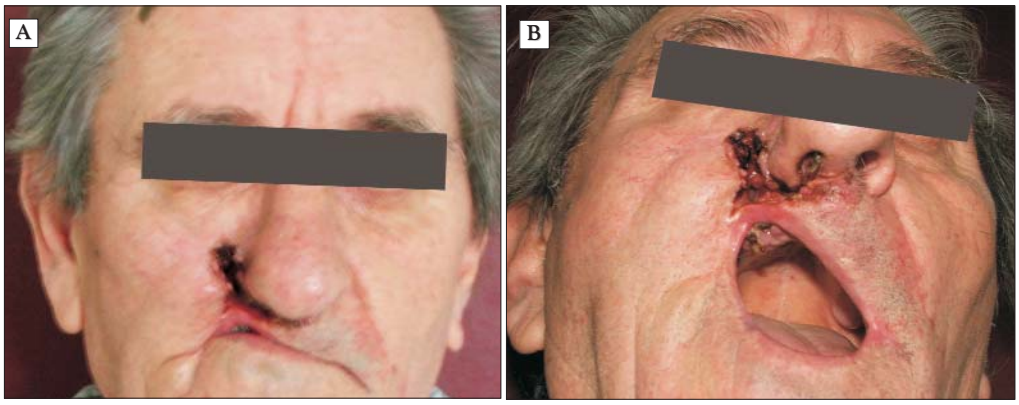

Figure 8. ***(A, B)*** *Preoperative aspects (Case 3)*

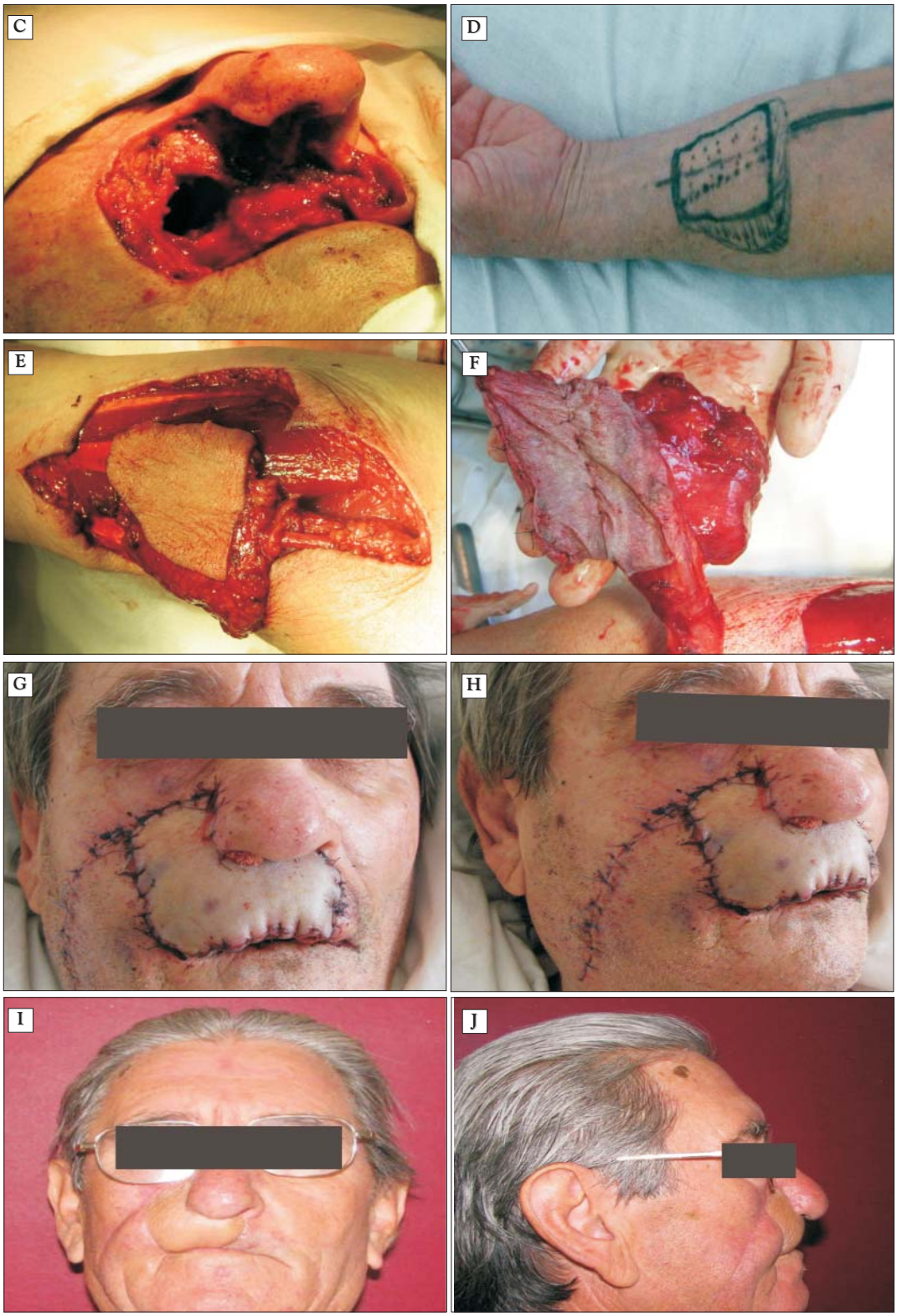

Figure 8.
(C,D,E,F) *Intraoperative aspects: postexcisional defect, radial flap harvested and grafted on it's deep part.*
(G,H,I,J) *Postoperative aspects, early (G,H) and late (I,J)*

Case 4

Squamous cell carcinoma of the lower lip operated, relapsed with secondary microstomia because of the infiltrative, retractile tumor. *(Fig. 9 A,B)*

Intraoperative aspects - *Fig. 9 C,D.*
Aspect at four days after the operation - *Fig. 9 E,F.*
Aspect at two months after the operation - *Fig. 9 G,H.*

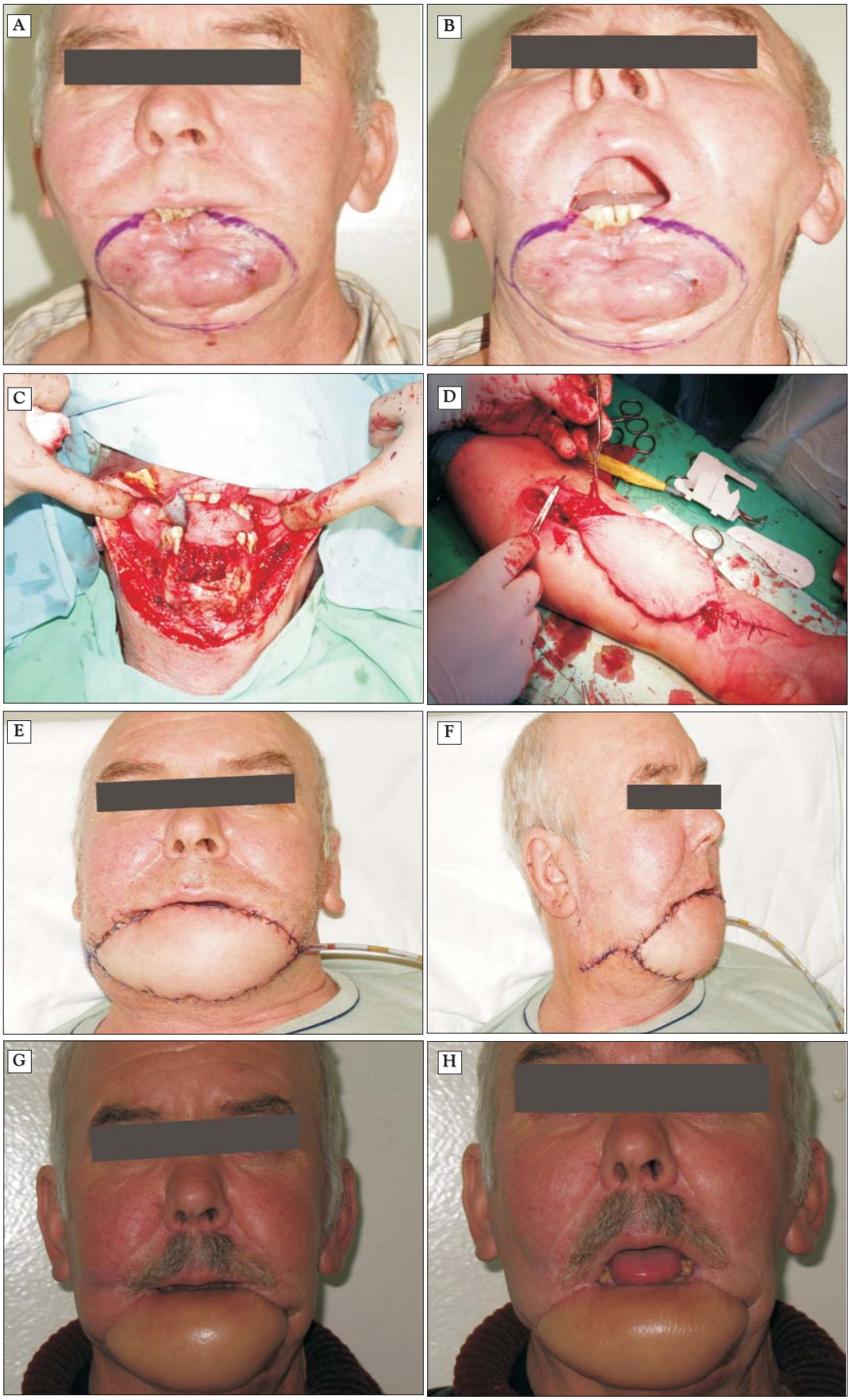

Figure 9. *(A,B) Preoperative aspects (Case 4).* ***(C,D)*** *Intraoperative defect and radial flap harvested. Postoperative early aspects* ***(E,F)****, and late aspects* ***(G,H)***

Case 5

Squamous cell carcinoma of the tongue and oral floor with osteoradionecrosis of the mandibula. *(Fig. 10 A,B)*

In this case after excision with radical intention in the first operation we choose an axial pectoral flap to cover the titanium plate used for mandibular reconstruction. After a few months the contraction of the flap led to insufficiency of the chin and mouth floor and we had to perform for reconstruction a free osteomiocutaneous fibular flap.

Intraoperatory aspect - *Fig. 10 C.*

The flap harvested and ready to cover the defect - *Fig. 10 D.*

Immediately after the operation and after a month - *Fig. 10 E,F,G.*

Discussions

Free tissue transplantation is a complex operation that requires a high level of technical experience and a good preoperative preparation. Even though in the beginning it was considered by many surgeons a radical procedure of last resort, today in the hands of the experienced microvascular surgeons who can execute it with a low complication rate, its position has shifted to that of being a routine and first choice reconstructive procedure.

In face reconstruction, free tissue transplantation is a method of great value, a method that allows us to reconstruct any defect as large and complex it might be. And also the best option for reconstruction when the local and regional reserves were used or are unsuitable.

Figure 10. ***(A,B)*** *Preoperative aspects (Case 5).* ***(C,D,E)*** *Free fibular flap, intraoperative images.* ***(F,G)*** *Postoperative aspects*

As the experience in this field increased many flaps were described and more complex reconstructions were performed, in the last few years free perforators flaps entered in the current practice, in order to provide cover for small defects, but with a very good aesthetic result and a low morbidity of the donor zone.

The free flaps that have been presented also have the great advantage of allowing reinterventions in the operated area considering that vascular independence lasts. This aspect is important because when needed, it permits further research under the flap when there is the possibility of a tumor reccurence, or when the improvement of the aesthetic aspects is wanted.

The experience obtained by approaching the previous presented cases confirms the conclusions from the plastic surgery literature referring to using a free tissue transfer in head and neck oncological surgery.

The radicality of the oncological excision is remains essential and the choice of the best recovery and reconstruction method remains the task of the plastic surgeon. Reconstructive microsurgery presently offers multiple choices which the surgeon must addapt to each case taking into account his personal experience.

We can consider now that free flap surgery is a very good promoter for the new step in microvascular surgery, which is face transplantation.

Conclusions

In face reconstruction every aesthetic unit is important, and when is possible the best surgical procedure is the one that replaces the whole unit lost or the entire face floor.

Free tissue transplantation can achieve that, and when we plan the reconstruction we always take in account the quality of the flap. The free flap we choose to transfer should be thick enough to cover the defect but not too thick to deform the region with a poor aesthetic result.

After many years of experience in this field, plastic surgery can move to the next step, which is face transplantation, for the most severe cases, with mutilation when no free flap can provide all the lost structures of the face. For reaching this goal, free flaps used in face reconstruction represent a major step in gaining experience for the surgical team, in order to perform this operation in selected cases.

Acknowledgement

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