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Interdisciplinary reconstruction of oncological resections at the skull base, scalp and facial region☆

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ABSTRACT

Extensive bone and soft tissue defects of the skull require unique plastic and reconstructive techniques to avoid and optimize aesthetic appearance following oncological resections. Procedures are ideally planned in an interdisciplinary board composed of neurosurgery, otorhinolaryngology, plastic and reconstructive surgery to facilitate reconstructive procedures of soft tissue and bone as early as possible in one approach. Large resections may require plastic surgery involvement from the beginning. Herein, we describe the function of a multidisciplinary approach to complex oncologic resections of the cranial base, scalp, and facial regions for neuro-oncologic patients.

Contents

1. Introduction

Extensive anatomic defects of the skull and skull base remain a

☆ In memoriam Prof. Dr. med. Dr. h. c. Wolfgang Draf FRCS Ed., Fulda.

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surgical challenge.

Often head and neck reconstructive surgery employ well established techniques of regional flaps or free microvascular grafts. Larger and unconventional resections require advanced techniques to provide an adequate functional and aesthetic result. These may include pedicled or free flaps of various options to protect vulnerable anatomic structure including intracranial structures, skull base, blood vessels and the nasopharyngeal cavity.

This manuscript outlines complex reconstructions applicable to the skull and skull base.

2. Scalp region

Hair bearing skin is defined as the scalp. Standard neurosurgical incisions combined with osteoplasties may impair perfusion. Defects may arise secondary to infection or insufficient tissue coverage that require plastic surgical reconstruction [1]. The thick skin of the scalp and the galea aponeurotica, a fibrous structure stretching between the frontalis and the occipitalis muscles, reduce scalp elasticity. This may complicate closure by preventing adequate stretching or transposition of the skin to provide adequate coverage. The vascular system of the scalp however consists of a network of paired arteries and veins in the supratrochlear, supraorbital, temporal, posterior and occipital regions which create a reliable perfusion network to facilitate rotation or transposition of tissues [2]. However, rotational flaps are limited principally to the scalp and forehead, where bi-lobed flaps can be dissected.

2.1. Axial pedicled flaps

Axial flaps of the pectoralis, latissimus dorsi, or trapezius muscle can reach only the neck, proximal skull, or mandibula. These flaps frequently do not provide sufficient bulk to fill the surgical cavities or coverage of the dura at the skull base [3]. Flaps raised within irradiated tissue are associated with an increased risk of poor perfusion and tissue necrosis. Therefore, radiation associated wound healing disorders and very large defects can be reconstructed successfully only by microvascular free flaps due to the amount of tissue that is required.

2.2. Microsurgical free flaps

Free flaps are very versatile as they may be derived from various donor sites [4]. They provide the amount of tissue and portablility required to reconstruct large and complex defects of the skull and skull base in excess of 95% [5]. Flaps raised on the subscapular vessels such as the latissimus flap are reliable and versatile enough to adjust to the local requirements of the individual patient [6]. In particular, the constant axial vascular anatomy and comfortable vessel size for microanastomosis are important factors for their safety in perfusion. Additional options are myocutaneous rectus abdominis [7] and gracilis flaps providing sufficient muscle volume or fasciocutaneous flaps with adequate skin such as groin flaps or anterolateral thigh flaps [2]. In the author's experience, the skin paddle of the gracilis myocutaneous flap, though well perfused on the surface, proved to be less reliable when used as a turned-in pedicle for reconstruction of the inner lining of the oral cavity.

2.3. Choice of recipient vessels

Sufficient vessel diameter and adequate perfusion pressure are a prerequisite for large flaps [8]. In the anatomic region to be reconstructed, the temporalis superficial vessels are not routinely used due to their inadequate size. For this reason, the authors favor the facial artery and vein. In case where appropriate inflow vessels are missing in the head and neck, arteriovenous loops may provide inflow to the flap in a synchronous fashion. This approach provides the necessary vasculature for microvascular anastomoses. These loops are pedicled on the brachiocephalic vein through anastomosis of its free distal end to the side to the axillary artery or by a free saphenous vein graft connected to the axillary or proximal

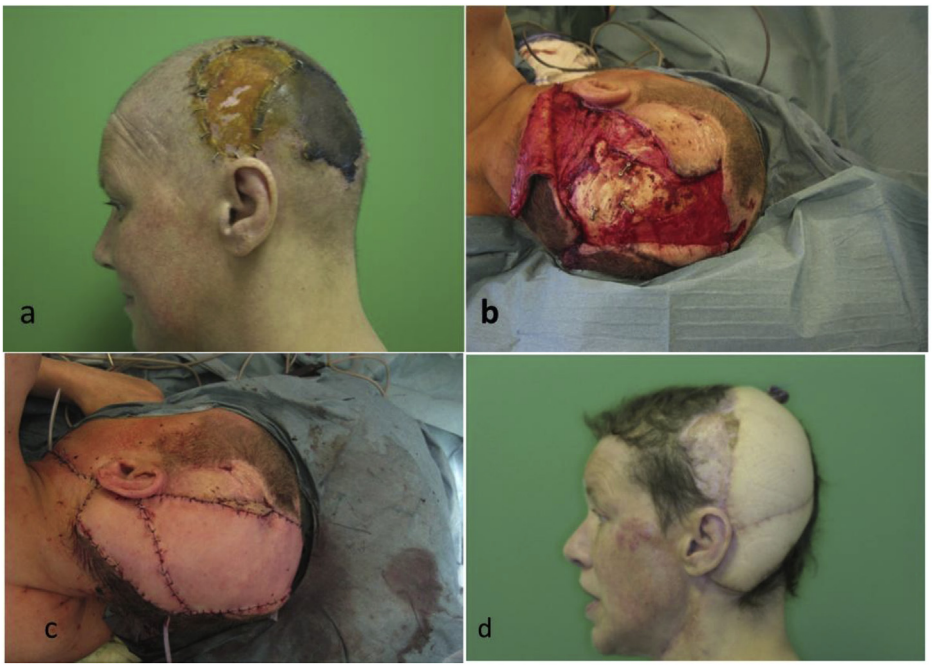

Fig. 1. Resulting soft-tissue defect at the parieto-occipital aspect, after resection of a brain tumor, osteoplasty and multi-directional incisions with failure of skin grafting (a). Defect after scarexcision with exposed osteoplasty (b).
Free microvascular Myocutaneous Latissimus Dorsi flap anastomosed to the facial vessels (c,d).