Reconstruction After Skull Base Surgery

Essay

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Abstract

Myocutaneous or muscle flaps provide vascularized soft tissue bulk and this is helpful to cover an area that may require postoperative radiation or may have been irradiated preoperatively and can minimize the risk of postoperative complications by filling dead space in the skull base region.

When large defects remain following tumor ablation, free tissue transfer is the best reconstructive option for the majority of patients. It provides well-vascularized tissue and because a free flap does not have the attachment of a pedicle, it can be designed and placed in the desired position and it provides well-vascularized tissue.

Key wards: Reconstruction - Skull Base Surgery

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List of abrreviations

ALT : Antero Lateral Thigh

BR : Brachio Radialis

CN : Cranial Nerve

CSF : Cerebro Spinal Fluid

EAC : External Auditory Canal

ENB : Esthesio Neuro Blastoma

FCR : Flexor Carpi Radialis

IAC : Internal Auditory Canal

ICA : Internal Carotid Artery

LCFA: Lateral Circumflex Femoral Artery

PMF : Pectoralis Major Flap

RFFF : Radial Forearm Free Flap

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The skull is divided into the cranium and the facial skeleton. The cranium is divided into the calvarium and the cranial base. The cranial base has an endocranial surface, which faces the brain, and an exocranial surface, which faces the nasal cavity and sinuses, orbits, pharynx, infratemporal and pterygopalatine fossae, and the parapharyngeal space. Both surfaces are connected by canals, foramina, and fissures through which numerous neural and vascular structures pass. Both the endocranial and exocranial cranial base surfaces are divided into anterior, middle, and posterior parts, each of which has a central and paired lateral portions . On the intracranial side, the three parts correspond to the anterior, middle, and posterior cranial fossae. (**Rhoton, 2002**)

The skull base regions are composed of complex tissue structures that give rise to histogenetically and biologically heterogeneous neoplasms of ectodermal, endodermal, and mesodermal origins. The vast majority of tumors at these locations are malignant with a small percentage being benign or tumor-like lesions. Accurate diagnosis and understanding of the clinical and pathologic presentations of the varied tumor nentities in this region are essential for proper management. (**Richardson, 2001**)

Considerable progress has been made during the last decade in the understanding of the complex anatomy of the skull base. Anatomical and clinical studies have contributed extensively to the development of new surgical approaches, while new imaging tools have significantly increased the accuracy of preoperative evaluation and postoperative follow-up of patients. Finally, the concept of cooperation between multidisciplinary teams was adopted for the treatment of these tumors allowing complete eradication of large tumors involving the skull base. (**Raveh et al, 1998)**

In fact, one of the most dramatic changes in the practice of skull base surgery over the past decade has been the introduction of endoscopic techniques to approach selected tumors of the anterior cranial fossa and ventral skull base. (**Kennedy, 2006**)

Accordingly, surgical ablation of skull base tumors started to prove itself as an effective tool in management .This inturn created complex post-ablative defects that need reconstruction. Lesions located in the skull base create a challenge for the reconstructive surgeon. Ablation of neoplasms in this region often requires extensive resection and this results in a large defect that often requires complex reconstruction (**Imola et al, 2003**)

Following tumor ablation, the reconstructive options available will be determined by the type of tissue required, the size and the position of the defect, and if there was exposure of the dura. There are numerous local soft tissue flaps which have been reported for use with skull base defects, including forehead and glabellar flaps. The pericranial and galeal flaps may be used when there is a small midline defect and they provide good soft tissue coverage with minimal donor site morbidity. (**Noone et al, 2002)**

Myocutaneous or muscle flaps provide vascularized soft tissue bulk and this is helpful to cover an area that may require postoperative radiation or may have been irradiated preoperatively. These muscle flaps provide good soft tissue contour and can minimize the risk of postoperative complications by filling dead space in the skull base region. The trapezius, the latissimus dorsi, and the pectoralis major muscles have been used as pedicled myocutaneous flaps for the management of these defects. The temporalis flap is a useful, reliable, and versatile option for reconstruction of a wide variety of cranial base defects. (**Chang et al, 2001**)

When large defects remain following tumor ablation, free tissue transfer is the best reconstructive option for the majority of patients. It provides well-vascularized tissue and because a free flap does not have the attachment of a pedicle, it can be designed and placed in the desired position and it provides well-vascularized tissue. (**Califano et al, 2003)**

Because a microvascular free tissue transfer may be harvested at the same time as the tumor ablation, it is possible to utilize a two-team approach; one team performing the tumor ablation and the second team performing the flap harvest. This two-team approach minimizes patient anesthesia time and thus decreases the risk of anesthesia-related complications. (**Teknos et al, 2002**)

The most commonly used free flaps in skull base reconstruction are: the rectus abdominis, the latissimus dorsi, the anterolateral thigh, and the radial forearm. When used, these flaps are harvested with a skin island, which can be used for coverage or lining, or de-epithelialized for bulk. For most skull base reconstructions, the rectus abdominis is the workhorse, and it is often used because of its ability to provide extensive skin coverage and allow for reconstruction of orbital and palatal defects simultaneously.

Regarding bony reconstruction, ascularized bone is superior to bone grafts due to its resistance to infection and osteo-radio-necrosis. Alternatively, synthetic hardware can be used, such as titanium mesh. (**Califano et al, 2003)**

Aim of the work

Accordingly, skull base reconstruction is having an increasing role in skull base surgery. The diversity of defects and continuously evolving reconstructive options rendered the choice of reconstruction extremely challenging. The aim of this work is to establish an algorithm for skull base reconstruction following tumor ablation based on the versatility of various reconstructive tools.

Anterior Cranial Base

The anterior cranial base can be defined as that portion of the skull base adjacent to the anterior cranial fossa. It is bounded anteriorly by the frontal bone, which contains two surgically important structures: the frontal sinus and the supraorbital foramina. The frontal sinus varies in size and extent, but its management is an important consideration in many if not most anterior cranial base operations. The supraorbital foramina, which in some persons may be incomplete (and therefore referred to as supraorbital notches), transmit the supraorbital nerves and vessels. These vessels contribute a major portion of the blood supply to the galea and the pericranium of the frontal region; they should be preserved if the galea and pericranium are to be used in the reconstruction of anterior cranial base defects.

Superiorly, the anterior cranial base is formed by the frontal, ethmoid, and sphenoid bones. From an intracranial perspective, several important landmarks are visible. The most anterior of these is the foramen cecum, which is the site of a communication between veins of the nasal cavity and the origin of the superior sagittal sinus. The next anatomic landmark, the crista galli, protrudes upward from the midline to provide attachment for the falx cerebri. On either side of the crista are the many openings in the cribriform plate, which transmit the olfactory nerves inferiorly. Just posterior to the last of these olfactory foramina is a smooth-surfaced area known as the planum sphenoidale; it forms the roof of the sphenoid sinus (when the sinus is well pneumatized). The anterior clinoid processes and lesser sphenoid wings delineate the most posterior limit of the anterior cranial base; here the middle cranial base begins. Between and slightly below the clinoids are the optic canals and the internal carotid arteries (ICAs); although technically these structures are not part of the anterior cranial base, they are sufficiently close that they should be protected during anterior cranial base resections. (Figure 1) (Tosun, 2003)

Second, the orbits contain several landmarks that can help surgical orientation during cranial base operations. The superior orbital fissure transmits the oculomotor, trochlear, ophthalmic, and abducent cranial nerves (CNs III, IV, V1, and VI) and the ophthalmic vein, and it communicates with the middle cranial fossa. The inferior orbital fissure contains the maxillary nerve and communicates with the pterygopalatine fossa; the lateral end