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Anterolateral corridor approach to the infratemporal fossa and central skull base in maxillectomy: rationale and technical aspects

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Abstract

We describe the technical aspects and report our clinical experience of a surgical approach to the infratemporal fossa that aims to reduce local recurrence after operations for cancer of the posterior maxilla. We tested the technique by operating on 3 cadavers and then used the approach in 16 patients who had posterolateral maxillectomy for disease that arose on the maxillary alveolus or junction of the hard and soft palate (maxillary group), and in 19 who had resection of the masticatory compartment and central skull base for advanced sinonasal cancer (sinonasal group). Early proximal ligation of the maxillary artery was achieved in all but one of the 35 patients. Access to the infratemporal fossa enabled division of the pterygoid muscles and pterygoid processes under direct vision in all cases. No patient in the maxillary group had local recurrence at median follow up of 36 months. Four patients (21%) in the sinonasal group had local recurrence at median follow up of 27 months. Secondary haemorrhage from the cavernous segment of the internal carotid artery resulted in the only perioperative death. The anterolateral corridor approach enables controlled resection of tumours that extend into the masticatory compartment.

Keywords: Sinonasal Cancer; Maxillary Cancer; Squamous Cell Carcinoma; Skull Base Surgery; Maxillectomy; Infratemporal fossa

Introduction

Local recurrence remains the most common manifestation of relapse after treatment for midfacial cancer.[1–6] In most patients it follows a predictable pattern, which can be explained by the relative inaccessibility of posterior and superior disease, and the proximity of vital structures,[2,6] and it is reflected in the T-staging for carcinoma of the maxillary sinus and ethmoid sinus.[7]

To maximise the likelihood of cure, operation is usually indicated for cancer of the midface,[2,6] and resection to uninvolved margins remains essential. The traditional technique for maxillectomy relies on posterior separation, which gives a poor view and inadequate vascular control, and for advanced

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and posteriorly-extending cancers of the maxilla it makes complete excision difficult.

We describe the technical aspects of an expanded field resection for cancer that involves the posterior maxilla, and report our experience.

Methods

Anatomical position of the maxillary artery in relation to the lateral pterygoid muscle

We examined 100 contrast-enhanced computed tomograms (CT) (slice width 0.9 mm, 200-300 mAs) from a consecutive series of patients with cancer of the head and neck, and noted the course of the maxillary artery with particular reference to the lateral pterygoid muscle. To measure the variance between observations, scans were read twice and the 2 readings were separated by 2 weeks.

Cadaveric investigation

We dissected 3 formalin-fixed cadaver heads (6 sides) using the anterolateral corridor approach. Maxillectomy was done in 3 sides and the central skull base was resected through the resulting defect.

Surgical technique

A standard Weber-Ferguson-Dieffenbach skin incision is made. Careful consideration is given to the amount of soft tissue (including skin) that requires excision anteriorly and laterally. When exenteration is indicated it is begun at this point by freeing the orbital contents superiorly and laterally. Occasionally resection of the zygomatic bone is necessary, but otherwise a zygomatic osteotomy is done. The origin of the masseter muscle is left attached except at its most anterior portion. The bone cut in the lateral orbit extends from the inferior orbital fissure to the zygomaticofrontal suture. The anterior bone cut extends from the inferior orbital fissure across the zygomatic bone, and when the tumour involves the maxillary sinus, it is kept lateral to the apex of the sinus. The osteotomy in the zygomatic arch is done by tunnelling from an anterior approach, and when completed, is displaced inferolaterally, pedicled on the masseter muscle.

The buccal fat pad with its temporal extension is then visible and is resected to provide a lateral margin, which exposes the temporalis muscle and coronoid process. When the tumour has arisen on the posterolateral maxillary alveolus, or has extended from the posterior surface of the maxilla, it is usually necessary to resect the caudal portion of the temporalis muscle with the coronoid process. If so, the temporalis muscle is divided in the temporal fossa. A key step is separation of the origin of the temporalis muscle from the infratemporal crest. The coronoid process of the mandible is then osteotomised. When the temporalis muscle can be preserved, the coronoid process can be used to support the inferior orbit after maxillectomy. In this case, the masticatory compartment of the infratemporal fossa is exposed by lateral and cephalad displacement of the coronoid process.

Osteotomies of the zygoma and coronoid process create a window on the posterior relations of the maxilla (Fig. 1).

Vascular control is then achieved by identification and ligation of the maxillary artery (Fig. 2). When it runs on the anterolateral aspect of the lateral pterygoid muscle it is easily found in a condensation of fat. When it runs on the posterolateral aspect of the muscle for most of its course it will emerge between the 2 heads of the lateral pterygoid close to the pterygopalatine fossa, and in this case it is found by dividing the caudal part (lower head) of the lateral pterygoid. The mandibular division of the trigeminal nerve, specifically its lingual and inferior alveolar branches, is identified lying on the lateral aspect of the medial pterygoid muscle below the inferior border of the lateral pterygoid. Division of the overlying lateral pterygoid muscle will show the maxillary artery crossing immediately superficial to the mandibular division of the trigeminal nerve. We found the artery to run deep to this structure in only one of the 35 clinical cases. To divide the medial pterygoid, the parapharyngeal fat plane on the deep aspect of the muscle is entered well below the tumour. The medial pterygoid is then divided from anterior to posterior, and the lingual nerve is kept under view to avoid injury. The lateral pterygoid muscle is divided from caudal to cephalad to expose the mandibular division of the trigeminal nerve as it exits the foramen ovale. Venous bleeding will be encountered from the plexus of veins in and around the lateral pterygoid, and from those that pass through the foramen ovale.

The pterygoid processes, which lie immediately anterior to the foramen ovale, are exposed on their lateral aspect and divided with an osteotome 0.5 cm below the base of the skull. The osteotome should be angled caudally as it passes medially, and the tip should not extend behind the posterior margin of the lateral pterygoid process. This will avoid injury to the anterior genu of the petrous portion of the internal carotid artery in the foramen lacerum. At this level the osteotomy of the pterygoid processes will extend into the caudal part of the pterygopalatine fossa. The maxillectomy is then completed in the standard way.

Removal of the main specimen exposes the central base of the skull and resection can be done as appropriate. Tumours that extend into the pterygopalatine fossa and adjacent infratemporal fossa will necessitate a drill out of the basisphenoid anterior to the foramen ovale (Fig. 3). The vidian canal is drilled out leading back to the foramen lacerum.[8] Bone around the foramen rotundum is drilled away and V2 is taken flush with the dura. When V3 is also involved, the structure can be resected more proximally. For neurotropic tumours we have extended resection to Meckel's cave. However, when the dura is opened, considerable venous bleeding