


En Bloc Resection of the Temporal Bone and Temporomandibular Joint for Advanced Temporal Bone Carcinoma

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Abstract

Advanced skin malignancies involving the temporal bone can involve the temporomandibular joint and glenoid fossa. Many of these tumors can be removed with a lateral temporal bone resection; however, extensive involvement of the glenoid fossa should include an en bloc resection of the temporal bone, glenoid fossa, and condyle. We describe a novel surgical approach that is an extension of a temporal bone resection that includes the glenoid fossa and condyle in an en bloc resection with the temporal bone. This procedure has been performed in 7 patients with advanced carcinoma of the temporal bone involving the glenoid fossa. There were no short-term complications as a result of the surgical approach. The addition of a middle fossa craniotomy and inclusion of the glenoid fossa and condyle as part of an en bloc resection of the temporal bone can be performed safely.

Keywords

temporal bone, temporal bone resection, squamous cell carcinoma, middle fossa craniotomy

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Advanced malignancies of the temporal bone may involve the temporomandibular joint (TMJ) and glenoid fossa. A traditional lateral temporal bone resection does not remove the glenoid fossa and TMJ with the temporal bone specimen, thus compromising the oncologic principle of en bloc resection. We describe a surgical technique to provide safe en bloc resection of malignant neoplasms involving the lateral temporal bone, glenoid fossa, and TMJ through a combined transmastoid and middle cranial fossa approach. This study was approved by

the University of Texas Southwestern Medical Center Institutional Review Board.

Surgical Procedure

The incision is determined by the extent of the tumor. A 2-cm margin around the tumor is planned. If the tumor is confined to the external auditory canal and auricle, a postauricular incision 2 cm from the postauricular sulcus is performed. This incision is then carried about 4 cm superior to the pinna. The auricle remains with the specimen depending on the extent of disease. A mastoidectomy is performed with subsequent identification of the short process of the incus, lateral semicircular canal, and vertical segment of the facial nerve (**Figure 1A**). The incus is removed and an extended facial recess is performed (**Figure 1B**).

The annulus is followed inferior and anterior until the TMJ is exposed inferiorly. The TMJ is exposed to the eustachian tube between the carotid artery and the anterior annulus using a small diamond bur. The zygomatic arch is sectioned. The temporalis muscle is incised and reflected anterior, inferior with an anterior, inferior pedicle to preserve the vascular supply.

A 4 × 4-cm middle fossa craniotomy is performed. The temporal lobe dura is then elevated in a posterior to anterior direction along the floor of the middle fossa. The arcuate eminence, foramen spinosum, middle meningeal artery, and the greater superficial petrosal nerve are then identified.

A retractor is placed under the petrous ridge, and the superior temporal bone cuts are made by connecting the tegmen mastoideum to the inferior craniotomy. The eustachian tube

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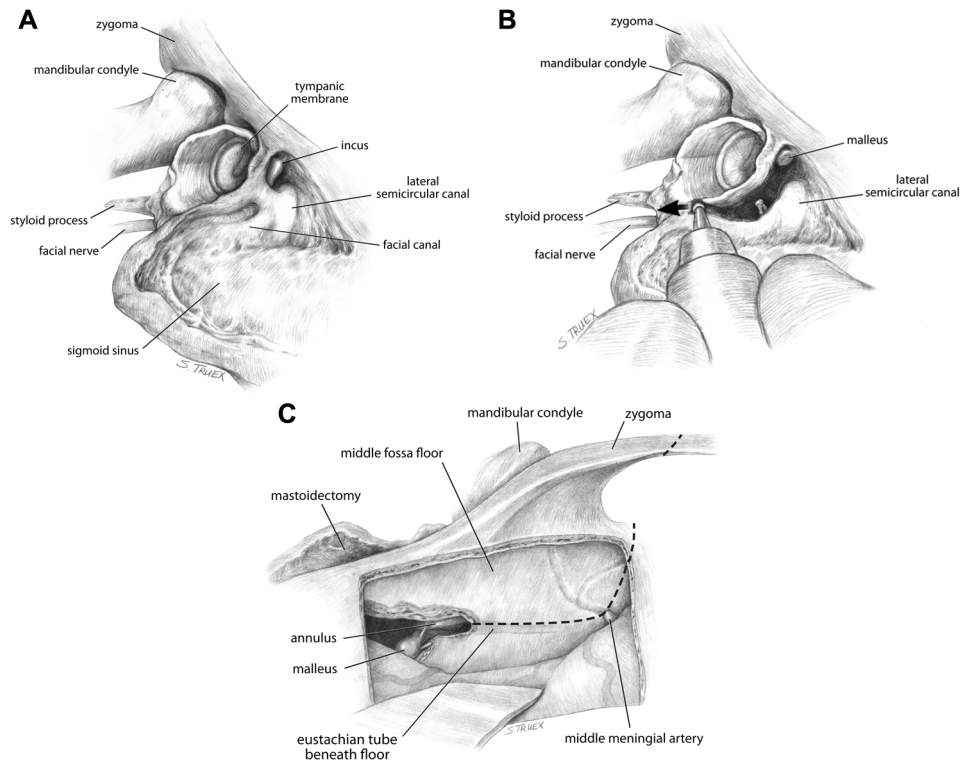


Figure 1. (A) A complete mastoidectomy is performed with visualization of the short process of the incus, lateral semicircular canal, and vertical segment of the facial nerve. (B) An extended facial recess is performed. (C) The superior cut is made from the middle ear and the roof of the eustachian tube to just lateral to the foramen spinosum and then out the anterior, inferior craniotomy site.

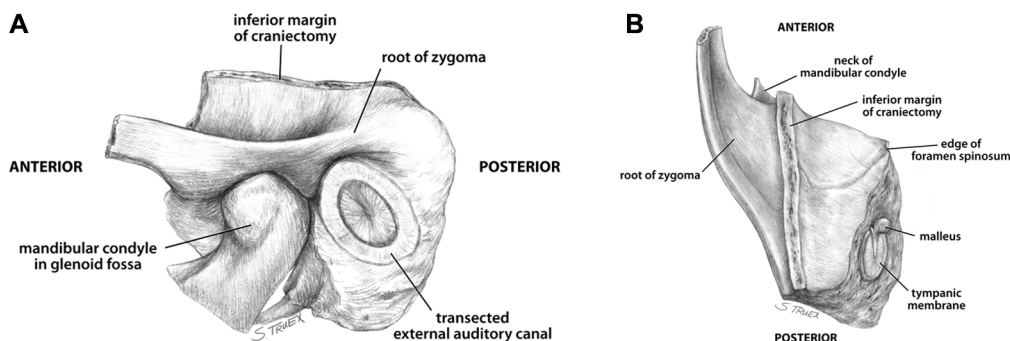


Figure 2. (A) Lateral view of the specimen showing the temporal bone resection, glenoid fossa, and condyle removed en bloc. (B) Superior view of the specimen showing the lateral middle fossa floor and superior aspect of the glenoid fossa. The medial surface of the tympanic membrane can be seen.

and malleus are identified. The dissection continues from the eustachian tube to the foramen spinosum and out the anterior, inferior craniotomy site (**Figure 1C**). A condylectomy is performed, allowing delivery of the specimen (**Figure 2**).

Figure 3 shows the surgical margins of the temporal bone resection from lateral, superior, and inferior.

All patients underwent a parotidectomy and neck dissection that was removed en bloc with the temporal bone resection. The specimen removed en bloc included the tympanic membrane, malleus, glenoid fossa, mandibular condyle, floor of the middle cranial fossa, contents of the infratemporal fossa, auricle, parotid, and neck contents. Bony and

soft tissue defects were reconstructed with either free flaps or regional rotation flaps. The glenoid fossa and condyle were not reconstructed.

Results

Seven patients with T3 or T4 carcinoma involving the temporal bone and glenoid fossa underwent a total auriculectomy; lateral temporal bone resection with inclusion of the glenoid fossa, condyle, parotidectomy; and neck dissection with regional or free flap reconstruction. Two patients (29%) had microscopically positive surgical margins. One margin was positive at the carotid artery in the neck, and

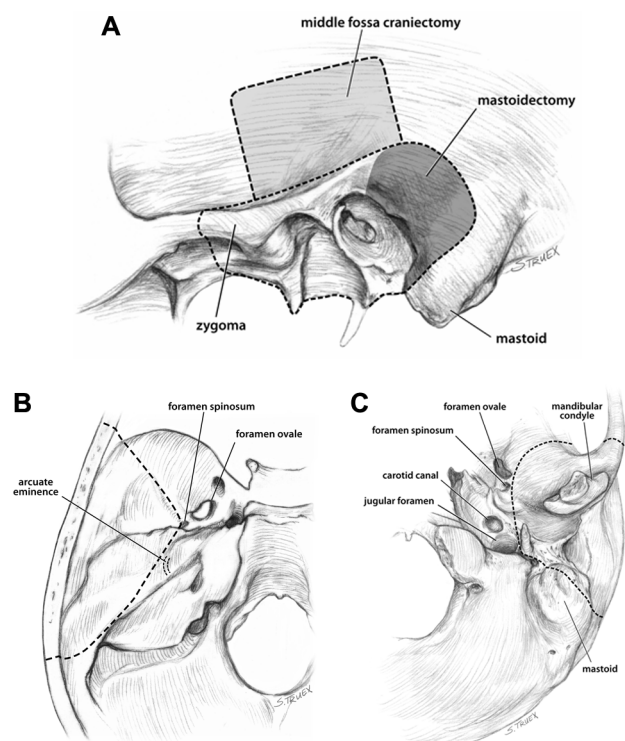


Figure 3. (A) Lateral view showing the cuts necessary to remove the lateral temporal bone, glenoid fossa, and condyle en bloc. (B) Superior view of the surgical margins. (C) Inferior view of the surgical margins.

the other margin was positive at the deep cervical muscles. The mean hospital stay was 8.6 days (range, 5-13 days). There were no episodes of postoperative cerebrospinal fluid leakage, meningitis, subjective memory loss, hemorrhage, or seizures. Two patients (29%) developed local or regional recurrence. The mean follow-up time was 1.2 years (range, 2 weeks to 4.5 years). Four patients died during the study period: 1 patient died as a result of locoregional recurrence and metastasis 6 months after resection, one patient with a history of renal transplant died of medical complications and tumor recurrence, 1 patient died due to underlying chronic lymphocytic leukemia, and 1 patient died 2 weeks after surgery of an unknown cause.

Discussion

Removing the glenoid fossa adds little additional morbidity compared with more limited temporal bone resections and allows for the possibility of an en bloc resection. The procedure was well tolerated with a low risk of perioperative complications.

Temporomandibular joint function was not assessed formally in the postoperative period. Roland and Marple¹ reviewed 5 cases of TMJ resection through a middle cranial fossa approach for benign diseases and concluded that, despite condylar excision, adequate mandibular range of motion, painless jaw movement, and resumption of a regular diet could be achieved with rehabilitation. One patient in this study required a temporary gastrostomy tube but was

able to tolerate a regular diet with speech therapy. Notably, this patient had undergone prior radiation therapy. A second patient complained of difficulty with masticating but was tolerating a regular diet without weight loss.

A limitation of this study is the small sample size and short follow-up. However, the aim of this study is to describe a surgical technique that allows for en bloc resection of advanced carcinoma involving the temporal bone and glenoid fossa. Based on a report with limited follow-up, it is unknown if this approach will improve survival, but this approach can be performed safely and adds little morbidity over a standard temporal bone resection.

Conclusions

The addition of a middle fossa craniotomy to a temporal bone resection resulting in the en bloc removal of the temporomandibular joint is a safe and effective technique for obtaining negative margins for advanced squamous cell carcinoma involving the temporal bone and temporomandibular joint. More studies are needed to determine whether this surgical approach will result in improved survival.

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Author Contributions

Joe Walter Kutz Jr, conception and design, acquisition of data, revised manuscript critically for important content, final approval of manuscript; **Derek Mitchell**, conception and design, acquisition of data, drafting of manuscript; **Brandon Isaacson**, revised manuscript critically for important intellectual contact, final approval of manuscript; **Peter S. Roland**, revised manuscript critically for important intellectual contact, final approval of manuscript; **Kyle P. Allen**, revised manuscript critically for important intellectual contact, final approval of manuscript; **Baran D. Sumer**, revised manuscript critically for important intellectual contact, final approval of manuscript; **Sam Barnett**, revised manuscript critically for important intellectual contact, final approval of manuscript; **John M. Truelson**, revised manuscript critically for important intellectual contact, final approval of manuscript; **Larry L. Myers**, conception and design, acquisition of data, revised manuscript critically for important content, final approval of manuscript.

Disclosures

Competing interests: Brandon Isaacson is a consultant for Medtronic and a consultant and a member of the advisory board for Advanced Bionics. Kyle P. Allen is on the advisory board for MedEl Corp.

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