

Middle cranial fossa approach for acoustic neuroma

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The middle fossa approach for the resection of small acoustic neuromas is a viable, but underutilized treatment modality with the goal of hearing preservation. The authors aim to demonstrate this approach and its nuances through this video presentation. A 38-year-old man presented with an incidentally discovered small, intracanalicular acoustic neuroma that was initially observed, but growth was noted. The patient had good hearing, and therefore a hearing preservation approach was offered. A gross-total resection was achieved, and the patient maintained good hearing postoperatively. This video demonstrates relevant anatomy, surgical indications, technical aspects of resection, including reconstruction, and postoperative outcomes.

The video can be found here: <https://stream.cadmore.media/r10.3171/2021.7.FOCVID21124>

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Transcript

This is Dr. Paul Gidley, and this is our middle cranial fossa approach for excision of acoustic neuroma.

0:27 Middle Fossa Anatomy. The middle fossa has a very complex anatomy, which is briefly reviewed here. Internal auditory canal lies at the same level as the external auditory canal. The key landmarks for the middle fossa are labeled here. An imaginary line drawn from the GSPN joins an imaginary line drawn from the arcuate eminence to form an angle that is roughly 90° to 120°. The internal auditory canal is found by bisecting this angle.

1:02 Patient Presentation. The patient presented is a 38-year-old man with an incidental acoustic neuroma first identified in 2012. It was observed to grow. This is his initial MRI showing a small intracanalicular tumor. Repeat imaging shows interval growth of the tumor. The audiogram shows good hearing in the right ear with a word understanding of 96%. ABR shows absent wave III and wave V on the right side.

1:43 Management Options. The options for management were explained to the patient, and these include observation with serial imaging, microsurgical resection, and stereotactic radiosurgery. The risk and benefits of each one of these approaches was outlined, and he opted for surgical excision.

2:03 Hearing Preservation Indications. Hearing preservation is offered to patients under the age of 65 with small tumors and good hearing. ABR waveforms should be intact to allow intraoperative monitoring.

2:19 Patient Preparation. The patient is positioned supine with the head in a Mayfield head holder. Electrodes for facial nerve monitoring are placed. ABR is performed intraoperatively. In this patient, the intraoperative waves I, III, and V were present. The skin is marked to outline a posteriorly based skin flap that follows the hairline.

2:42 Incision/Craniotomy. Temporalis fascia is harvested and set aside. An anterior temporalis muscle flap is elevated. Craniotomy is planned to be centered at the external auditory canal measuring 4 cm high and 4 cm wide. It is important that the sides of the craniotomy are parallel.

3:08 Dural Elevation/Identification of Middle Fossa Anatomy. The patient is then given mannitol and is hyperventilated to allow dura elevation. Dura elevation is performed from a posterior-to-anterior direction. Dura is elevated until the posterior fossa, arcuate eminence, and middle meningeal artery are identified. A House-Urban retractor is then placed at the petrous apex. The middle fossa anatomy can then be examined. The arcuate eminence and the GSPN are marked here. Imaginary

lines outlining these two structures are marked here, with bisection here, which should overlie the IAC.

3:57 Drilling. Drilling starts over the arcuate eminence in order to blue-line the superior semicircular canal. The superior semicircular canal is always perpendicular to the posterior petrous ridge. Any air cells that are opened during this dissection are sealed off with bone wax. The blue line of the canal is seen here. Drilling then continues anterior and medial to the superior semicircular canal to open up the air cells of the petrous apex. This drilling continues until the dura of the posterior fossa is encountered. The bone around the porus is completely removed, exposing the dura. Drilling is then continued laterally along the internal auditory canal. Drilling continues until Bill's bar is reached. The remaining thin shell of bone over the internal auditory canal is removed with Fisch instruments.

5:17 Dural Opening/Tumor Resection. The dura of the internal auditory canal is then opened with a 5910 Beaver blade. The dura is reflected to show the facial nerve anteriorly and superior vestibular nerve posteriorly. A Prass probe is used to identify the facial nerve and to separate it from the superior vestibular nerve. The superior vestibular nerve is reflected posteriorly, and the tumor can be seen between it and the facial nerve. The superior vestibular nerve is then cut with microscissors to allow better visualization of the tumor from the inferior vestibular nerve. The tumor can then be elevated out of the internal auditory canal by severing its lateral attachment to the inferior vestibular nerve. The tumor is then carefully and bluntly separated from the facial nerve and the cochlear nerve, which is seen here as a bright white, densely myelinated nerve. The facial nerve is then stimulated with a Prass probe to ensure its integrity.

6:44 Reconstruction. A portion of temporalis muscle is then harvested. This muscle is used to plug the defect in the internal auditory canal. Temporalis fascia is laid over the muscle plug to reconstruct the middle fossa. A bone chip is then placed over the defect in the petrous apex and the middle fossa retractor is then removed. The craniotomy flap is placed back into its anatomical location, rigidly fixated with plates. The temporalis muscle and skin flaps are then closed in a watertight fashion.

7:36 Postoperative Management. Patients are observed overnight in the ICU. An MRI is obtained the following day and the patient is observed another 3 or 4 days until they meet discharge criteria.

MRI 3 years later shows no evidence of disease. Post-operative audiogram shows class B hearing, with an SRT of 35 and a discrim score of 88%.

In our practice, we have found that patients with class A or B hearing preoperatively are able to maintain class A or B hearing in 67% of cases after undergoing middle cranial fossa resection of acoustic neuroma, consistent with other modern reports.

8:13 References¹⁻¹⁰

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this publication.

Author Contributions

Primary surgeon: Gidley, DeMonte. Editing and drafting the video and abstract: Gidley, Passer, Page. Critically revising the work: all authors. Reviewed submitted version of the work: all authors. Approved the final version of the work on behalf of all authors: Gidley.

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