Minimally invasive access to the posterior cranial fossa: an anatomical study comparing a retrosigmoidal endoscopic approach to a microscopic approach

Jason Van Rompaey, BS, Carrie Bush, MD, Brian McKinnon, MD, C. Arturo Solares, MD.
Georgia Health Sciences University (Augusta, GA) - Georgia Skull Base Center - Department of Otolaryngology. Augusta Georgia.

ABSTRACT

Objectives: The central location and complex neurovascular structures of the posterior cranial fossa make tumor resection in this region challenging. The traditional surgical approach is a suboccipital craniotomy utilizing a microscope for visualization. This approach necessitates a large surgical window and cerebellar retraction, which can result in patient morbidity. With the advances in endoscopic technology, minimally invasive access to the cerebellomedullary cistern can be achieved with minimal manipulation of uninvolved structures, reducing the complications associated with the suboccipital approach.

Methods: An endoscopic approach was completed on anatomic specimens. To access the central structures of the posterior cranial fossa a retrosigmoidal approach was undertaken. A keyhole craniotomy was made in the occipital bone posterior to the junction of the transverse and sigmoid sinuses. The endoscope was advanced and photographed were obtained for review. The exposure was compared to that obtained with a microscope.

Results: The endoscopic retrosigmoidal approach to the posterior cranial fossa provided increased exposure to the midline structures while minimizing the surgical window. The relevant anatomy was identified without difficulty.

Conclusion: An endoscopic retrosigmoidal approach to the midline structures of the posterior cranial fossa is anatomically feasible. The morbidity associated with retraction of the cerebellum could possibly be avoided, improving patient outcomes. Retrosigmoidal endoscopy provides access to anatomical structures that were not possible using a microscope in a suboccipital approach. Further understanding of the endoscopic anatomy of the posterior fossa can allow for advances in cranial base surgery with improved safety and efficacy.

INTRODUCTION

The cerebellopontine (CP) angle is located in the anatomically dense skull base and can be associated with a wide variety of pathology that may require surgical intervention. The pathology may include neurovascular compression and aneurysms, however the most common disease requiring surgical excision are tumors.1,5 The limited access to this region has prompted investigators to develop methods of creating an adequate surgical corridor while limiting the damage and sacrifice of surrounding structures.

The microscope is utilized for the visualization of the CP angle, as it allows for the viewing of the fine anatomical structures, resulting in successful tumor extirpation and neural decompressive treatments.2 However for the microscope to obtain an adequate surgical corridor, retraction of the cerebellum is required, with the consequence of cerebellar manipulation, increasing the possibility of morbidity.5,7 This associated morbidity has prompted the investigative use of endoscopy in the application of CP access.5 Endoscopy is applied to many surgical disciplines enabling adequate visualization while minimizing injury to surrounding anatomy. Endoscopic surgery to the skull base may obviate many of the drawbacks with open approaches.3 The deep and complex nature of CP anatomy makes this region an attractive candidate for endoscopic assisted surgery.1,5 The purpose of this study is to evaluate the extent of surgical visualization that can be achieved with an endoscopic retrosigmoidal approach to the CP angle. A comparison to the views created by a microscope and an outline of the procedures taken to access the various structures will be made.

METHODS AND MATERIALS

Retrosigmoidal keyhole craniotomy

The craniotomy for the retrosigmoidal approach is made with the intention of creating the ideal path to the CP angle while avoiding hemorrhage of the transverse and sigmoid sinuses. A lateral suboccipital craniotomy allows a direct path to the CP angle with minimal retraction of the cerebellum. This approach is parallel and interpositioner to the superior petrosal sinus and the petrosal portion of the temporal bone.

Dissection Technique

Using a zero degree endoscope and a bimanual micro-dissection technique the arachnoid mater was removed surrounding the cerebellopontine angle while limiting the damage and sacrifice of surrounding structures. The endoscope is then placed superiority in relation to the craniotomy. This enabled access to cranial nerves V and VI without damaging cranial nerves VII and VIII. Cranial nerve IV was then dissected at the tentorial incisure. This nerve was dissected medial to its origin, inferior to the inferior colliculus.

Anterior to CN V the petrosal vein was then divided from the tentorial edge allowing the endoscope to be directed deeper into the posterior fossa towards the clivus. This permitted greater visualization of CN III, which was then dissected. Advancing the endoscope along the petroclival border into the sella allowed direct visualization of the pituitary stalk and mamillary bodies. Digital high definition photographs were then obtained of all the relevant structures.

As the endoscope is advanced rostrally to view CN V, there is the possibility of seeing structures medially to the endoscope, such as CN VIII. This view of CN V shows an adequate surgical window not obtained with a microscope. The endoscopic approach improves visualization giving a much broader view of the cerebellopontine angle. This is achieved with a minimized retrosigmoidal craniotomy, that in turn limits cerebellar retraction. The endoscopic approach provides better access from cranial nerves III through XII as well as views of the brainstem, clivus, infundibulum and inferior colliculus.

CONCLUSIONS

Views of CN III, IV, SCA & cerebellum

NI V, VIII, IX, X, XI can be obtained. A clear view of the infundibulum can be obtained, however the depth of endoscopic insertion limits a working corridor. This approach could be combined with encodiscope to access tumors of this region.

REFERENCES