Retrosigmoid Transtentorial Approach: Technical Nuances and Quantification of Benefit From Tentorial Incision

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■ OBJECTIVE: **The transtentorial extension of the retrosigmoid approach allows for improved visualization of the brainstem and petroclival region. This approach is an important tool in the skull base surgeon's armamentarium for pathologies involving the petroclival region. It has been shown that the addition of tentorial transection improves the exposed surface area of the brainstem. However, no data have been reported regarding the depth of the additional anterior and medial exposure. The goal of the present study was to describe the additional depth of exposure gained by performing tentorial transection. This information allows surgeons to preoperatively estimate the amount of operative exposure gained by this technique.**

■ METHODS: **Five preserved cadaveric heads were dissected using frameless image guidance. A standard retrosigmoid craniotomy was performed, followed by tentorial transection. The boundaries of the surgical exposure and depth of the surgical field were compared before and after tentorial transection.**

■ RESULTS: **After transection, we found a 20.1-mm increase in anterior exposure ($P < 0.01$) and a 13-mm increase in medial exposure ($P < 0.01$). No significant difference was found in the extent of the superior ($P = 0.32$) or lateral ($P = 0.07$) exposure. The surgical working distance increased significantly from 68.8 to 90.3 mm ($P < 0.01$).**

■ CONCLUSIONS: **When performing retrosigmoid craniotomy, the addition of tentorial transection allows for a significant increase in anterior and medial exposure with no significant increase in superior or lateral exposure.**

INTRODUCTION

The choice of surgical approach for posterior fossa pathologies requires a detailed understanding of the exposure needed to visualize the lesion and the surrounding neurovascular structures. The retrosigmoid craniotomy, used alone or combined, is a workhorse approach for skull base surgeons. Previous studies have shown that a combination of staged orbitozygomatic and retrosigmoid approaches provides excellent access with potentially less morbidity compared with transpetrous approaches.[1-7] Various methods of extending the standard retrosigmoid approach to improve exposure of the brainstem and petroclival region have been described.[6,8-16] Although these limited reports have described the technique, they have been primarily useful for surgical exposure for lesions intrinsic to the brainstem.[17,18] Although it is true that tumors in the petroclival region can displace the anatomy such that the surgeon has an operative corridor, to the best of our knowledge, no studies have yet quantified the increased exposure obtained by cutting the tentorium cerebelli, especially in normal specimens. In the present cadaveric study using frameless stereotaxy, we sought to determine the limitations of the retrosigmoid approach after transtentorial extension. To the best of our knowledge, we have provided the first measurement data for this extended approach. With the advances in endoscopic-assisted skull base surgery, this approach potentially represents an underused and useful extension of retrosigmoid craniotomy.

Key words
- Craniotomy
- Meningioma
- Petroclival
- Posterolateral
- Retrosigmoid
- Skull base
- Transtentorial

Abbreviations and Acronyms
CN: Cranial nerve
CT: Computed tomography
SPS: Superior petrosal sinus

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METHODS

Retrosigmoid Technique

Five preserved cadaveric heads (Medical Education and Research Institute, Memphis Tennessee, USA) that had been previously injected with colored silicone into the arterial and venous systems were used. Volumetric computed tomography (CT) scans were obtained of each head. These scans were loaded into image guidance software (Stryker, Kalamazoo, Michigan, USA). Rigid Mayfield fixation was performed with the head rotated away from the surgeon. The goal of the approach was to maximize the superior access; therefore, the head was placed in flexion. After registering the head to the image guidance software, the navigation probe was used to outline the transverse and sigmoid sinuses. A gentle S-shaped incision was performed, and the cranium was exposed. A standard retrosigmoid craniotomy measuring 3 cm in diameter was performed using a high speed drill, exposing the dura along the transverse and sigmoid sinuses. The dura was then opened in a T-shaped fashion and reflected away. The operative microscope was then introduced. No fixed retractor system was used. Retraction was performed with cotton pads and suction by the surgeon. The initial exposure included arachnoid dissection to free cranial nerves (CNs) IV–XII. The superior cerebellar and anterior inferior cerebellar arteries were identified. The superior petrosal vein was identified and divided to aid in exposure.

Using the navigation probe for the image guidance platform, the superior, medial, and anterior boundaries of the exposure were stored. In the standard retrosigmoid approach, these anatomic boundaries were the tentorium cerebelli just lateral to the incisura, the petrous face of the temporal bone along

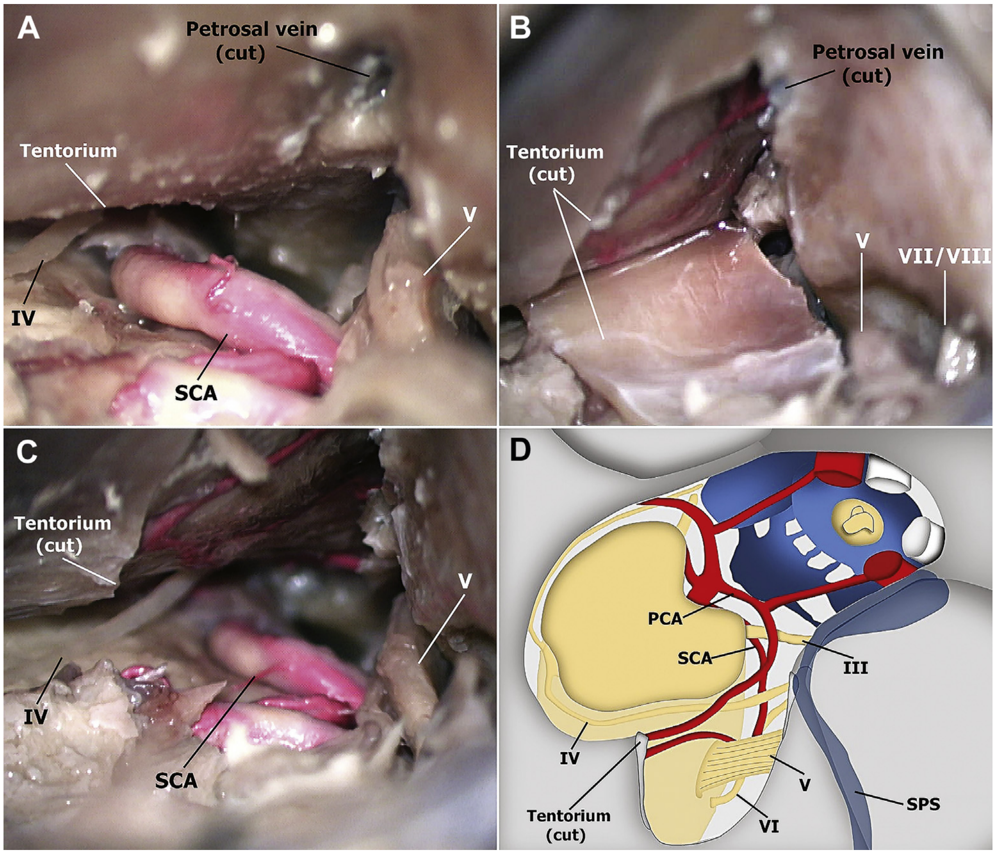

Figure 1. View through operating microscope showing (**A**) operative view before, (**B**) during, and (**C**) after tentorial transection. The microscope was angled toward the petroclival fissure to illustrate the view from a traditional retrosigmoid approach. Before transection, the fourth cranial nerve (IV) should be directly visualized medially and, if necessary, gently mobilized off the incisura. (**D**) Simulated view from an area near the postcentral gyrus illustrating the anatomical structures of the approach. After tentorial transection, the increase in superior exposure allows for visualization of the superior neurovascular structures. The increase in anterior exposure allows for visualization of the posterior aspect of the cavernous sinus. III, third cranial nerve; PCA, posterior cerebellar artery; SCA, superior cerebellar artery; SPS, superior petrosal sinus; V, fifth cranial nerve; VI, sixth cranial nerve; VII/VIII, seventh/eighth cranial nerve.