The Retrolabyrinthine Presigmoid Approach to the Anterior Cerebellopontine Region: Expanding the Limits of Trautmann Triangle

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■ OBJECTIVE: **The anatomic area exposed through exposure of Trautmann triangle may not be sufficient. We studied the additional exposure provided by skeletonizing the sigmoid sinus (SS).**

■ METHODS: **In 5 human cadaveric heads, thin-cut computed tomography images of 2 sides of the temporal bone were obtained for a total of 10 sides. The estimated surgical working angle was calculated based on the relationship of the SS to the posterior semicircular canal (PSC), superior petrosal sinus, and jugular bulb on imaging. Mastoidectomy was performed, and heads with and without SS skeletonization were remeasured.**

■ RESULTS: **Working angle calculated on computed tomography was 56° ± 11.3. Skeletonization of the SS increased the distance between the PSC and SS by 5 mm ($P = 0.01$) and between the lateral semicircular canal and SS by 4 mm ($P = 0.01$). Skeletonization and retraction of the SS significantly increased the distance between the PSC and lateral semicircular canal to the SS. On images obtained after mastoidectomy, skeletonizing the SS helped improve anterior visibility on most samples that had an SS that was lateral to the PSC on axial imaging. In samples in which the SS was medial to the PSC or had only minimal lateral displacement, skeletonizing the SS did not markedly improve visibility of the retrolabyrinthine space.**

■ CONCLUSIONS: **Working area and visibility improved as the PSC and SS approached the same plane on axial imaging. Preoperative evaluation of the laterality of the SS to the PSC may assist a surgeon in determining the need for skeletonizing the SS and avoiding possible vascular injuries.**

INTRODUCTION

The presigmoid retrolabyrinthine approach has several advantages, such as lower morbidity than a translabyrinthine approach owing to hearing preservation and a low risk of facial nerve injury.[1-3] However, the anatomic area uncovered through the exposure of Trautmann triangle (TT) may not provide a sufficient working area. Attention has been directed toward the relationship of the superior jugular bulb (JB) to the internal auditory meatus, but little is known regarding the need to skeletonize the sigmoid sinus (SS) based on its relationship to the posterior semicircular canal (PSC). We hypothesized that expansion of TT provides a larger exposure of lesions located at cranial nerve entry zones and the lateral brainstem. The aim of this study was to measure the additional exposure and visibility provided by skeletonizing the SS and drilling of the PSC and to determine if there is a subset of patients who would not benefit from exposure of the SS based on the depth of the operative field provided by the relationship between the PSC and SS.

MATERIALS AND METHODS

In 5 adult human cadaveric heads, thin-cut computed tomography images of 2 sides of the temporal bone were obtained for a total of

Key words
- Acoustic
- Retrolabyrinthine
- Semicircular canal
- Sigmoid sinus
- Sinodural angle

Abbreviations and Acronyms
CPA: Cerebellopontine angle
IAC: Internal acoustic canal
JB: Jugular bulb
LSC: Lateral semicircular canal
PSC: Posterior semicircular canal
SS: Sigmoid sinus
TT: Trautmann triangle

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Table 1. Premastoidectomy and Postmastoidectomy Measurements (mm)

Cadaver Sides	LSC/PSC to SS (Medial vs. Lateral)	PSC to SS	LSC to SS	Perpend* PSC to SS	Perpend* LSC to SS	EAM to SS
1	Lateral SS	9.6	13.6	4.4	8.8	15.3
2	Medial SS	16.3	18.5	14.3	17	19
3	Lateral SS	9.6	12.8	9	12.7	17.8
4	Lateral SS	19.7	23.1	13.4	16.9	22
5	Lateral SS	15.9	17.9	6.1	10.1	16.7
6	Lateral SS	13.7	15.1	4.7	8.1	13.4
7	Lateral SS	15.8	17.8	12.6	15.7	17.2
8	Lateral SS	12.0	14.0	8	12.1	16.2
9	Medial SS	14.0	18.0	9	13.8	16.4
10	Lateral SS	13.0	15.0	9	15.7	17.3

LSC, lateral semicircular canal; PSC, posterior semicircular canal; SS, sigmoid sinus; EAM, external acoustic meatus.
*Perpendicular distances measured before mastoidectomy by placing a laterally drawn line on SS and measuring the shortest perpendicular distance to PSC and LSC on axial computed tomography.

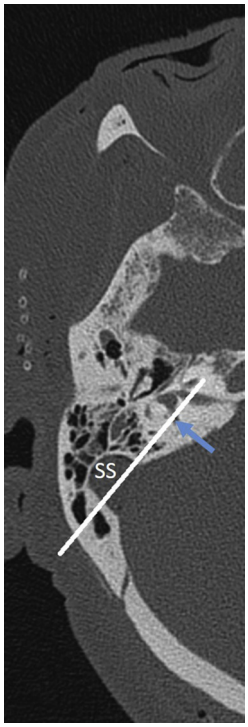

Figure 1. Lateral location of the sigmoid sinus (SS). A *line* has been drawn at the angle of the lateral semicircular canal and posterior semicircular canal (*arrow*). The cortical bone covering the SS is located lateral to the line, and the working space appears limited.

10 sides. The estimated working angle was calculated based on the relationship of the SS to the PSC, superior petrosal sinus, and JB on imaging. Mastoidectomy was performed to calculate the following distances in the presigmoid retrolabyrinthine space after the PSC was drilled: external acoustic meatus to SS, PSC to JB, PSC to SS, and lateral semicircular canal (LSC) to SS. The SS was then skeletonized with the use of a 5-mm soft touch burr, and gentle retraction was applied. Measurements of the SS were then repeated. Samples were photographed. Measurements were also verified manually to ensure correctness.

Data were analyzed using IBM SPSS Statistics for Windows Version 23 (IBM Corp., Armonk, New York, USA). Variables were summarized as mean ± SD, and means were compared using a paired sample t test. Correlation coefficients were calculated using Pearson correlation. A P value <0.05 was considered to be statistically significant.

RESULTS

Table 1 shows the imaging and dissection measurement results. There were 2 medial and 8 lateral sides included in the analysis. The distance between the external acoustic meatus and SS was measured at dissection with microcalipers and was significantly correlated to the measured distances on axial images by placing a laterally drawn line on the SS and measuring the shortest perpendicular distance to the PSC ($r = 0.82$, $P = 0.02$) and LSC ($r = 0.859$, $P = 0.01$). Skeletonization of the SS significantly increased the distance between the PSC and SS by 4.9 mm (13.96 mm ± 3.13 vs. 9.05 mm ± 3.49; $P < 0.001$) and the LSC and SS by 4.2 mm (16.97 mm ± 3.50 vs. 12.76 mm ± 3.83; $P = 0.01$).

After mastoidectomy, skeletonizing the SS improved anterior visibility on 8 samples that had an SS that was lateral to the PSC on axial imaging (Figures 1 and 2). In samples in which the SS was medial to the PSC or had only minimal lateral displacement, skeletonizing the SS did not markedly improve visibility of the