VESTIBULAR SCHWANOMMA EXCISION: EXPERIENCE AT OUR INSTITUTE KING HUSSEIN MEDICAL CITY: RETROSIGMOID VS. TRANS LABYRINTHINE APPROACH

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ABSTRACT

Background: Vestibular schwannomas are benign tumors that often require surgical intervention. The retrosigmoid and translabyrinthine approaches are the most commonly used techniques, each with distinct advantages and complications.

Aims: To evaluate and compare the clinical presentation, surgical outcomes, and postoperative complications of vestibular schwannoma cases managed with retrosigmoid and translabyrinthine approaches.

Methods: A retrospective review of 24 patients treated at King Hussein Medical City from January 2021 to June 2023 was conducted. Radiological and audiological assessments were performed pre- and postoperatively. Surgical collaboration involved ENT and neurosurgery teams.

Results: Hearing loss (90%) and tinnitus (70%) were the most common symptoms. Seventeen patients underwent the retrosigmoid approach and seven the translabyrinthine. Facial nerve weakness was more common in the retrosigmoid group, while CSF leaks were higher with the translabyrinthine approach (57%). Hearing was completely lost in all translabyrinthine cases, while 33% of retrosigmoid cases preserved hearing.

Conclusion: Surgical approach selection should be tailored to individual cases, balancing hearing preservation, facial nerve function, and complication risks.

Key words: Retrosigmoid approach, translabyrinthine approach, vestibular schwannoma, CPA tumor.

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INTRODUCTION

A vestibular schwannoma (also known as acoustic neuroma, acoustic neurinoma, or acoustic neurilemoma) is a benign, usually slow-growing tumor that develops from the balance and hearing nerves supplying the inner ear. The tumor comes from an overproduction of Schwann cells—the cells that normally wrap around nerve fibers like onion skin to help support and insulate nerves .it is considered the most common tumor in the cerebellopontine angle.

Cerebellopontine angle (CPA) is a triangular space in the posterior cranial fossa that is bounded by the tentorium superiorly, brainstem poster medially and petrous part of temporal bone poster laterally. It is an important landmark anatomically and clinically as it is occupied by the CPA cistern, which houses the cranial nerve V, VI, VII, and VIII along with the anterior inferior cerebellar artery.It can be classified on the basis of size or the anatomical extent (Koo's Classification).

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The most typical clinical manifestation is a unilateral hearing loss that progresses over time and is accompanied by tinnitus. Vertigo, aural, and less common symptoms including facial/corneal numbness (trigeminal), tongue or shoulder weakness (hypoglossal and accessory), headache, and other cerebellar presentations (ataxia and gait disturbance).

Audiological assessment frequently reveals asymmetric sensorineural hearing loss more for higher frequencies with poor speech discrimination.

The gold standard test for its diagnosis is a gadolinium enhanced T1 weighted MRI. It displays the whole course of the seventh and eighth cranial nerves, from the brainstem to the final organ.

The majority of treatment is surgical removal, however other modalities can also be recommended, including stereotactic radiosurgery and simple observation (for tiny, asymptomatic tumors). Translabyrinthine and retrosigmoid surgical techniques are the 2 most often used methods for its excision is retrosigmoid and translabyrinthine.

In our institutional surgical practice, the strategic selection of surgical approaches is informed by a meticulous assessment of the anatomical features, specifically leveraging the internal acoustic canal (IAC) as a pivotal point of consideration. For tumors situated within the posterior fossa, extending from the IAC and below, the retrosigmoid approach is consistently deemed as the preferred modality. Conversely, in cases involving sizable tumors exhibiting expansion from the middle fossa into the posterior fossa, particularly those associated with non-serviceable hearing ears, the translabyrinthine approach constitutes the preferred operative strategy within our institutional framework. This discerning approach underscores a nuanced consideration of anatomical parameters and functional outcomes to optimize the efficacy of tumor resection.

The sigmoid sinus is maintained as the posterior boundary of exposure in the translabyrinthine approach. A large cortical mastoidectomy is performed (**Figure 1**) after a post-aural incision and periosteum elevation, which is followed by a bone labyrinthectomy (**Figure 2**). The cochlear aqueduct is skeletonized, the IAC is detected, the tumor is revealed, and it is subsequently removed after the dura has been resected (**Figure 3**)

The sigmoid sinus serves as the anterior barrier as a craniotomy is performed using the retrosigmoid approach. (Figure 4 and **Figure 5**) show the retraction of the visible cerebellum and the identification and drilling out of the IAC.

The underlying tumor tissue is then removed (**Figure 7**) once the dura has been revealed (**Figure 6**).

In our institutional approach, the determination between the retrosigmoid and translabyrinthine approaches is not contingent upon tumor size, as we recognize the adaptability of each approach to accommodate varying tumor dimensions through specific modifications. For instance, within the retrosigmoid approach, an extended craniotomy and the implementation of a lumbar drain afford the creation of a sufficiently expansive corridor. Similarly, the translabyrinthine approach incorporates extensive drilling of the mastoid, labyrinth, cochlea, tentorial division, exposure of the middle fossa dura, and skeletenization of the sigmoid sinus, with subsequent posterior retraction,

facilitating adaptability to larger tumors. While acknowledging the existence of alternative approaches such as the middle fossa approach, primarily indicated for small and laterally positioned tumors relative to the internal acoustic canal (IAC), it is noteworthy that our institution does not currently employ this particular approach in our surgical repertoire. This strategic decision aligns with our institutional commitment to a specialized and tailored selection of approaches based on meticulous considerations of anatomical and clinical parameters.

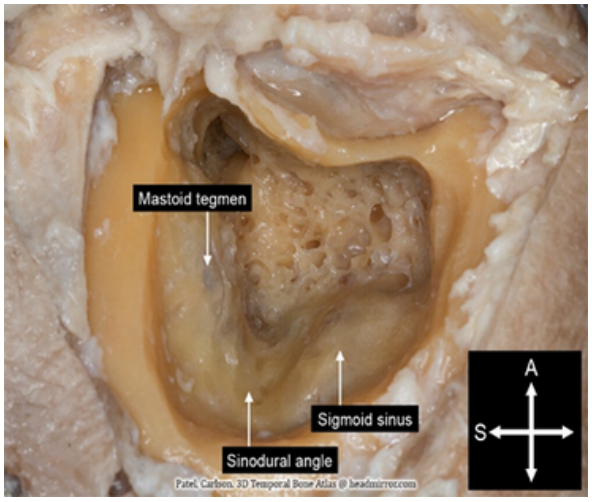


Figure 1: Mastoidectomy with skeletenization of the sigmoid sinus. both the mastoid antrum and the sinodural angle are illustrated.

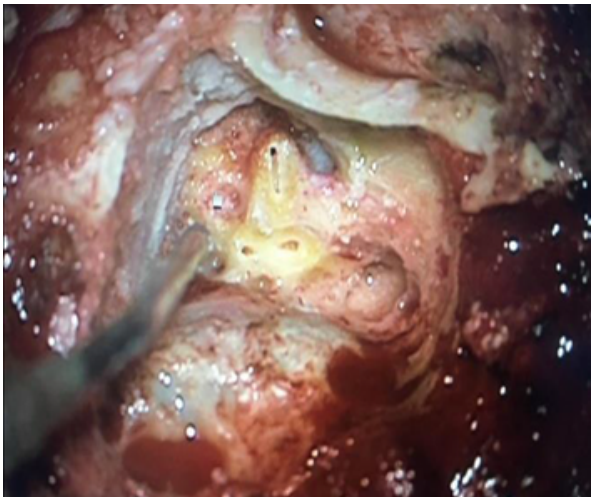


Figure 2: labyrinthectomy (removal of the vestibule and the semicircular canals).

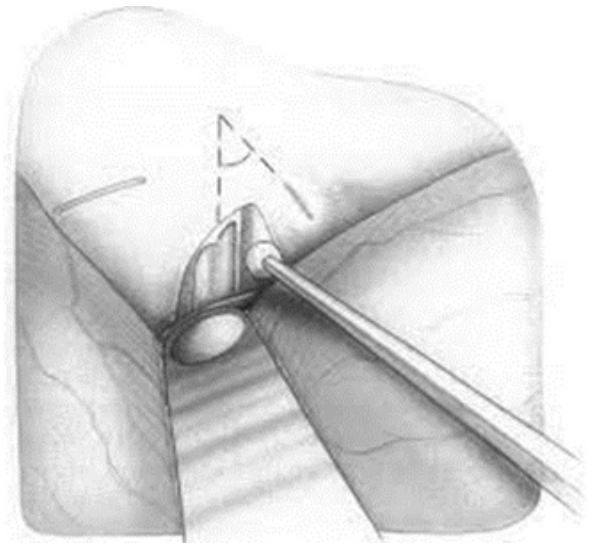


Figure 3: IInternal acoustic canal drilling through transabyrinthine approach.

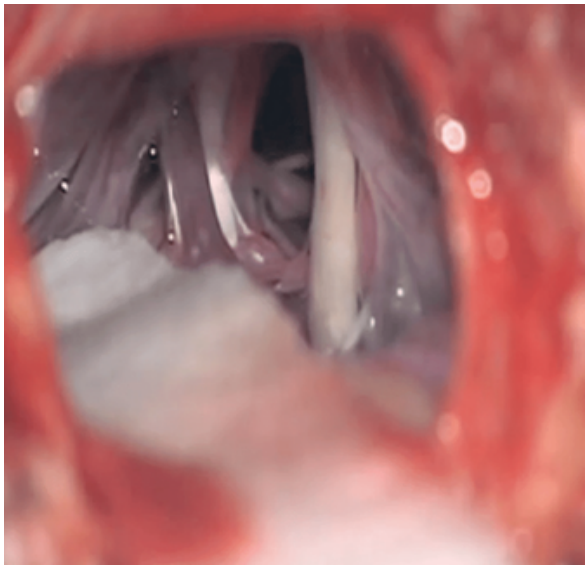


Figure 4: In retrosigmoid approach the sigmoid sinus is the anterior border of this approach and medial gentle traction of the cerebellum to visualize the tumor and the cranial nerves.

Figure 5: Retro sigmoid approach and drilling of the internal acoustic canal.

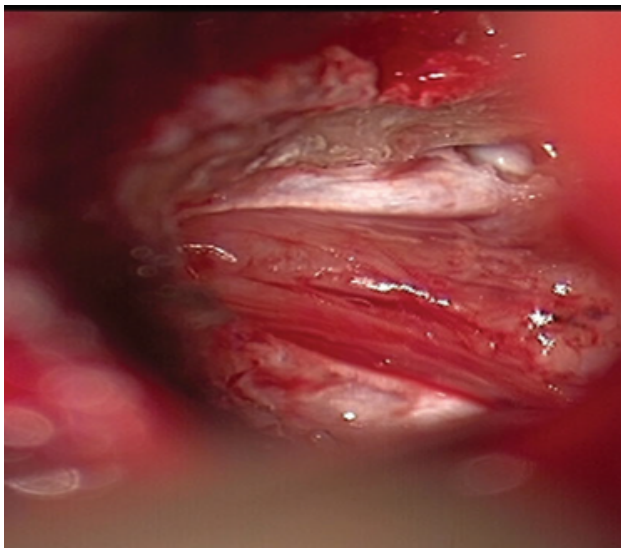


Figure 6: After drilling out of the internal acoustic canal the dura is exposed and opened.

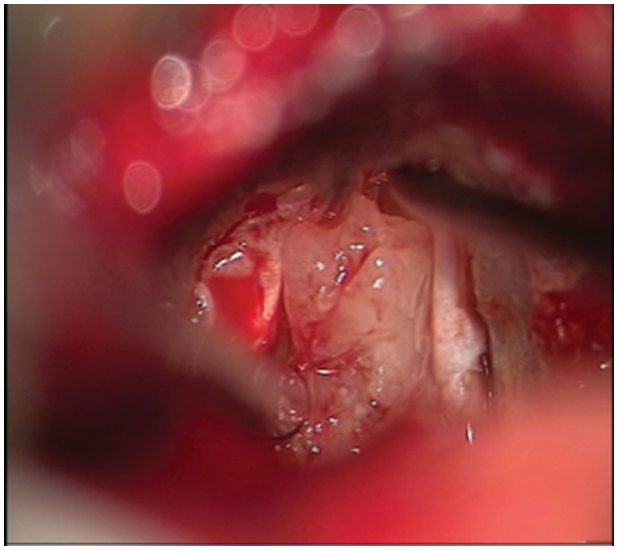


Figure 7: The tumor is removed

METHODS

Between January 2021 and June 2023, a retrospective interventional investigation was carried out at king Hussein medical city. 24 individuals had acoustic schwannoma surgeries overall. Excision was chosen. They were all chosen based on radiographic findings that point to a vestibular schwannoma. Patients underwent routine blood tests in preparation for surgery.

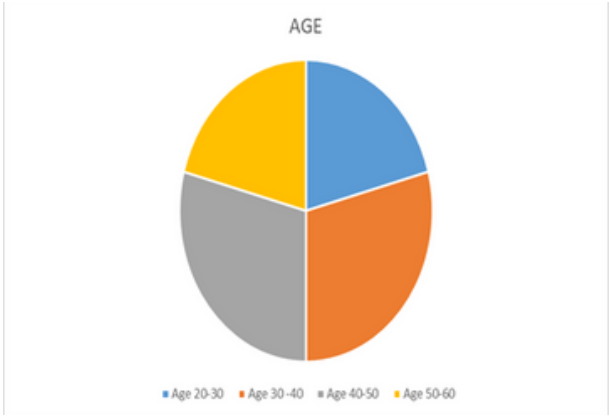
In order to evaluate each patient's preoperative hearing state, PTA was performed in the institute's audiological section (king Hussein medical city). All patients in our institute's radiological department had gadolinium enhanced contrast MRIs. Seven of the 24 patients were operated on using the translabyrinthine route (30 %), and 17 were operated on using the retrosigmoid technique (70 %). The majority of patients were released from the hospital 1 week following surgery, barring any difficulties. In the immediate aftermath of surgery, it was carefully monitored for facial nerve weakening using house Brackman staging. Pure tone average and SDS score were used to evaluate hearing loss. Patients were evaluated before being discharged. This included a clinical evaluation of facial nerve function, an MRI with contrast to check for any residual mass, and a fresh hearing assessment. They were monitored for an 8 to 12 months, during which time all of these investigations were repeated, and the outcomes of the two groups were compared.

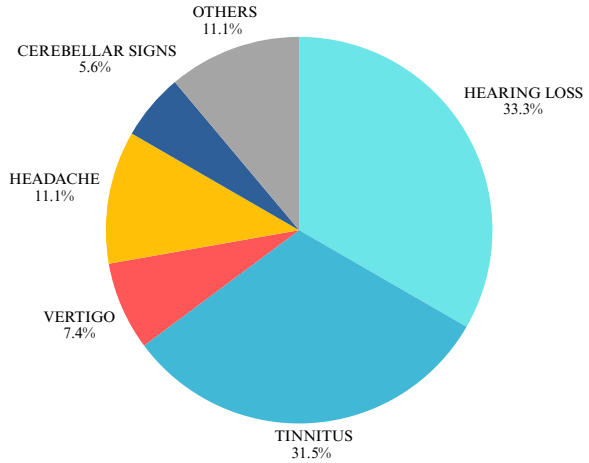
RESULTS

Number of cases 24

Patients were selected from the 20 to 60-year-old age range. The average age of the presenters was 40. Most of the patients were between the ages of 30 and 40.

Presenting Symptoms: Hearing loss and tinnitus were almost present in patients, followed by more uncommon symptoms such vertigo, headaches, and cerebellar symptoms. Nearly all patients who had a significant headache when they first came in had obstructive hydrocephalus.





Complications

Recurrence or residual tumors: On the post-op MRI, a few patients had a little residual tumor.

"The translabyrinthine approach demonstrated a superior outcome with a 100% total resection rate and no residual tumors, as compared to the retrosigmoid approach, which achieved an 80% total resection rate with a 20% residual tumor presence."

An aggressive surgical procedure can frequently worsen the situation by harming the facial nerve and impairing its function. A small amount of residual tumor tissue may be left in case removal could harm the facial nerve because to its benign nature, moderate growth, and predisposition in middle age. The size of one patient's big cystic vestibular schwanoma increased on the MRI taken a year after surgery compared to the scan taken just after surgery. For radiation or radiosurgery, the oncology division received a referral for him.

The comprehensive evaluation of recurrence rates subsequent to total tumor removal necessitates an extended and prolonged follow-up period, extending up to 15 years. It is imperative to note that our current study did not encompass such an extended duration for follow-up, which may impact the comprehensive understanding of long-term recurrence patterns.

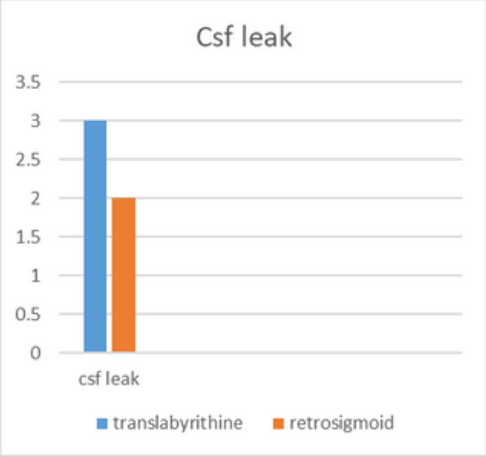
CSF Leak: CSF rhinorrhea, a sign of CSF leak, was seen in 3 patients approached by retrosigmoid approach (17.6%). 4 patients experienced CSF otorrhoea or a CSF fistula at the incision site approached by translabyrinthine approach (57%). Both individuals who experienced CSF rhinorrhea received packing (tap and

wrap), oral acetazolamide, hydration restriction, and head elevation 45 degrees as a conservative management. Two patient required surgical intervention. one of them was operated previously by retrosigmoid and the other by translabyrinthine approach.

Face nerve weakness: Both in the immediate post-operative period and on the 1-year follow-up visit, face weakness of grade II or greater was noted. Only one patient who underwent a translabyrinthine approach to surgery experienced facial paralysis in the immediate postoperative term (**14%**). six of the patients who underwent retrosigmoid surgery experienced facial paralysis right away (**35 %**), and four of them continued to have it one year later (**23%**).

Post-operative hearing loss:

A drawback of the translabyrinthine technique is that it causes total post-operative hearing loss. As a result, it is only performed on patients who had hearing loss prior to surgery. The retrosigmoid approach can preserve hearing because the labyrinths are still intact. Only 1/5 (3 patients) of those who underwent surgery using the retrosigmoid technique had hearing loss that was of an unacceptable level (**13 %**), whereas one third (5) of those patients had the same preoperative hearing levels (**29%**).



	Trans labyrinthine	Retro sigmoid
Hearing As Preoperative Level	0 (0%)	6 (35%)
Loss Present But An Acceptable Level	O (0%)	7 (41%)
Loss Present At Unacceptable Level	0 (0%)	1 (5%)
Complete Hearing Loss	7 (100%)	0 (0%)

Hearing Assessment as Showed In Table Above. Early facial weakness for Translabyrinthine vs. Retrosigmoid approaches.

The Fisher's exact test was performed to compare the occurrence of early facial weakness between patients undergoing the Translabyrinthine and Retrosigmoid surgical approaches. In the Translabyrinthine group, out of a total of 7 patients, only 1 patient exhibited early facial weakness, while the remaining 6 did not. Conversely, in the Retrosigmoid group, 6 out of 17 patients experienced early facial weakness. The odds ratio calculated from this distribution was approximately 0.306, suggesting that the odds of developing early facial weakness were lower for the Translabyrinthine group compared to the Retrosigmoid group. However, the statistical significance of this finding, as measured by the p-value, was not established since the p-value was 0.625, which is considerably higher than the conventional threshold of 0.05.

Additionally, the 95% confidence interval for the odds ratio ranged from 0.041 to 2.302. The fact that this interval includes the value of 1 indicates that the difference in the odds of early facial weakness between the two surgical approaches is not

statistically significant. Moreover, the wide span of the confidence interval reflects a considerable degree of uncertainty around the odds ratio estimate, likely due to the small sample size involved in the study.

In summary, while the initial data suggest that patients undergoing the Translabyrinthine approach may have a lower risk of early facial weakness compared to those undergoing the Retrosigmoid approach, the evidence is not statistically significant. The results should be approached with caution given the limitations posed by the small sample size, which affects the reliability of the odds ratio estimate and the width of the confidence interval. Further studies with larger cohorts are warranted to better understand the relationship between surgical approach and the risk of early facial weakness.

Table 1: Comparison of Early Facial Weakness Incidence Between Translabyrinthine and Retrosigmoid Surgical Approaches: A Fisher's Exact Test Analysis

	Event (Weakness)	No Event (No Weakness)	Odds Ratio	P-value
Group 1 Translabyrinthine	1	6	0.306	0.625
Group 2 Retrosigmoid	6	11		

Late facial weakness for Translabyrinthine vs. Retrosigmoid approaches.

In the comparison of late facial weakness between patients who underwent the Translabyrinthine and Retrosigmoid surgical approaches, the data presents a notable difference in the incidence of this symptom. For the Translabyrinthine group, none of the 7 patients experienced late facial weakness, whereas in the Retrosigmoid group, 4 out of 17 patients exhibited this condition. The calculated odds ratio for this comparison is 0.0. This figure typically indicates that the event (late facial weakness) did not occur in the first group (Translabyrinthine). While an odds ratio of zero could be interpreted as a complete absence of risk in the Translabyrinthine group compared to the Retrosigmoid group, the interpretation is complicated by the small sample size and the presence of a zero count in the contingency table.

Furthermore, the p-value of 0.283 exceeds the common threshold of 0.05, suggesting that the observed difference in the incidence of late facial weakness between the two surgical groups is not statistically significant. It implies that we cannot confidently state that one surgical approach is associated with a lower risk of late facial weakness than the other based on this data.

The confidence intervals for the odds ratio are reported as 0.0 due to the zero cell count, which indicates a limitation in the statistical analysis. In such cases, the confidence interval may not provide meaningful information, and the interpretation of the odds ratio becomes less straightforward.

In conclusion, the data shows no instances of late facial weakness in the Translabyrinthine group, the absence of statistical significance and the challenges posed by the zero count in one of the groups warrant cautious interpretation of these results. Further investigation with larger sample sizes and potentially different statistical methods might be required for a more definitive understanding of the relationship between surgical approach and late facial weakness risk.

Table 2: Impact of Surgical Approach on Late Facial Weakness: A Comparative Analysis between Translabyrinthine and Retrosigmoid Methods

	Event (Weakness)	No Event (No Weakness)	Odds Ratio	P-value
Group 1 (Translabyrinthine)	0	7	0	0.283
Group 2 (Retrosigmoid)	4	13		

Total resection for Translabyrinthine vs. Retrosigmoid approaches.

In the analysis of total resection rates between patients undergoing Translabyrinthine and Retrosigmoid surgical approaches, the data reveals a distinct pattern. In the Translabyrinthine group, all 7 patients had a total resection of the targeted area, while in the Retrosigmoid group, 14 out of 17 patients underwent total resection, with the remaining 3 having partial resection.

The Fisher's exact test yields an odds ratio of infinity. This result typically occurs when one of the comparison groups has a zero count for one of the outcomes, as is the case with the Translabyrinthine group for partial resection (zero occurrences). While an infinite odds ratio might suggest a very high likelihood of total resection with the Translabyrinthine approach, it's important to interpret this with caution due to the limitations inherent in the data, particularly the zero-cell count.

The p-value of 0.530, which is above the conventional threshold of 0.05, indicates that the observed differences in total resection rates between the two groups are not statistically significant. This finding suggests that there is no substantial evidence to support a difference in total resection rates between the Translabyrinthine and Retrosigmoid approaches based on this dataset. The confidence intervals are also reported as infinity due to the presence of a zero count in the contingency table. This affects the reliability of the confidence interval as a statistical measure and limits the interpretability of the odds ratio.However, the Translabyrinthine approach showed a 100% rate of total resection in this dataset, the lack of statistical significance and the zero count issue necessitate a careful interpretation of these results. Further research, ideally with larger sample sizes and a more balanced distribution of outcomes, would be beneficial to gain clearer insights into the effectiveness of these surgical approaches in achieving total resection.

Table 3: Comparison of Total Resection Rates Between Translabyrinthine and Retrosigmoid Surgical Approaches

	Event (Total Resection)	No Event (Partial Resection)	Odds Ratio	P-value
Group 1 (Translabyrinthine)	7	0	Infinity	0.53
Group 2 (Retrosigmoid)	14	3		

CSF leak development for Translabyrinthine vs. Retrosigmoid approaches

The statistical analysis of CSF Leak Development between the Translabyrinthine and Retrosigmoid surgical approaches, as determined by Fisher's exact test, offers significant insights with potential clinical implications. The calculated odds ratio of approximately 6.22 suggests a notably higher risk of CSF leak development in patients undergoing the Translabyrinthine approach compared to those undergoing

the Retrosigmoid approach. This substantial odds ratio indicates that the likelihood of experiencing a CSF leak is over six times greater for patients treated with the Translabyrinthine surgery, a finding that could be crucial in surgical planning and patient counseling, especially in cases where the risk of CSF leaks is a primary concern.

However, the p-value associated with this comparison stands at around 0.134. While this value does not reach the conventional threshold for statistical significance (typically set at 0.05), it does indicate a notable trend that warrants attention. This p-value suggests the presence of a potential difference in the incidence of CSF leaks between the two surgical methods. However, the evidence is not strong enough to conclusively affirm this difference at the standard level of statistical significance. Therefore, while the data point towards a higher risk of CSF leaks with the Translabyrinthine approach, this conclusion should be approached with caution. The findings, although not statistically significant, underscore the need for further research, perhaps with a larger sample size or additional variables, to gain a more definitive understanding of the risks associated with these surgical techniques.

Table 3: Incidence of CSF Leak Development in Translabyrinthine vs. Retrosigmoid Surgical Approaches

Approach	Event (CSF Leak)	No Event (No CSF Leak)	Odds Ratio	P-value
Group 1 (Translabyrinthine)	4	3	6.22	0.134
Group 2 (Retrosigmoid)	3	14		

CONCLUSION

The surgical strategy for a patient with a vestibular schwannoma—or any CP Angle tumor, for that matter—is heavily influenced by their hearing level. According to our study, the trans labyrinthine method can be recommended for patients in whom post-surgical hearing is not an issue, such as those who already have hearing loss in the operating ear. The retrosigmoid technique should be preferable in other patients if hearing preservation was a goal.

The final decision regarding the treatment plan should always be made by the surgeon based on their knowledge and skill. The single most crucial determinant, the size and extent of the tumor, determines the postoperative problems following excision.

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