Endoscopic Versus Microscopic Retrosigmoid Approach for Vestibular Schwannoma Resection

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Abstract

Vestibular schwannomas are benign cerebellopontine angle tumours for which surgical management has evolved toward preservation of neurological function and quality of life. The retrosigmoid approach remains a commonly used corridor, traditionally performed with the operating microscope. However, limitations in visualization, particularly within the internal auditory canal, have lead to increasing adoption of endoscopic techniques. This review evaluates current evidence comparing fully endoscopic, endoscopic-assisted, and conventional microscopic retrosigmoid approaches. The most robust comparative data demonstrate that fully endoscopic surgery achieves outcomes comparable to microscopy in terms of gross total resection and facial nerve preservation. Endoscopic approaches offer improved visualization of concealed anatomical regions and may enhance extent of resection, especially in tumours with intracanalicular extension. Additionally, reduced surgical invasiveness has been associated with improved postoperative recovery and decreased morbidity. Endoscopic-assisted microsurgery remains a widely practiced transitional technique, combining the benefits of both modalities. Despite these advantages, endoscopic assisted technique is more practical in resource limited settings than fully endoscopic.

Keywords: Vestibular Schwannoma, Retrosigmoid approach, Miscroscopic surgery, Endoscopic

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Introduction

Vestibular schwannomas (VS) are benign tumours arising from Schwann cells and account for approximately 85% of lesions at cerebellopontine angle (CPA). Common clinical presentation includes ipsilateral sensorineural hearing loss, vertigo, and facial paralysis.[1,2] The treatment goal has shifted from prioritizing gross total resection (GTR) alone to achieving resection while preserving facial and cochlear nerve function and maintaining overall quality of life.[1]

The retrosigmoid approach remains a widely used surgical corridor, traditionally performed using the operating microscope. However, limited visualization in microscopic technique due to linear illumination makes access difficult to concealed areas like fundus of the internal auditory canal (IAC).[1,3,4] This limitation has led to adoption of endoscopic techniques. Both fully endoscopic and endoscopic-assisted retrosigmoid approaches offer improved illumination and visualization, potentially improving surgical precision.[5] Despite increasing use, comparative evidence remains limited. This review aims to evaluate current literature comparing outcomes of conventional microscopic versus endoscopic and endoscopic-assisted technique in vestibular schwannoma surgery.

Review of Literature

The surgical paradigm in vestibular schwannoma management has shifted significantly toward preserving neurological functioning, particularly of facial and cochlear nerves. The retrosigmoid approach remains to be commonly used with emerging endoscopic techniques. While the retrosigmoid approach continues to be a mainstay, the incorporation of endoscopic techniques represents a shift toward minimally invasive surgery. These techniques can improve surgical and functional outcomes.

Comparative outcomes: Endoscopic vs microscopic surgery

The most robust comparative evidence is provided by the matched cohort study by Lang et al. (2026), which evaluated fully endoscopic retrosigmoid keyhole surgery against conventional microscopic surgery in patients with small to medium vestibular schwannomas.[1] The study demonstrated comparable rates of gross total resection (94.1% vs 91.2%) and facial nerve preservation (House-Brackmann grade I-II at 1 year: 91.2% vs 88.2%) between the endoscopic and microscopic groups, respectively. Complication rates including cerebrospinal fluid leak and infection were also similar between both approaches. Notably, the endoscopic group showed a significantly smaller craniotomy size and reduced postoperative

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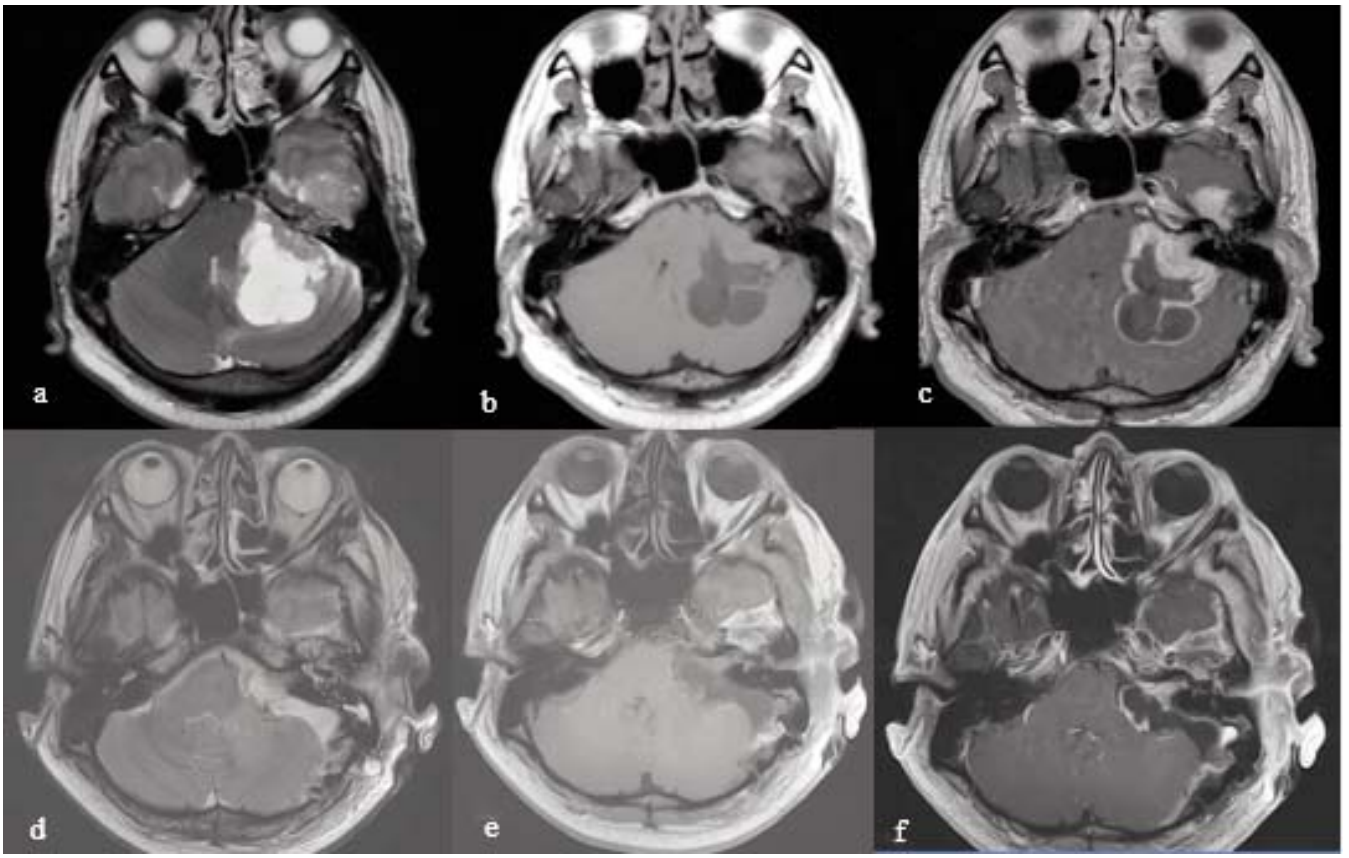

Figure: a, b, c show T2-, T1-, and T1 post-contrast images, respectively, of a middle-aged woman presenting with left-sided hearing loss and headache. The images demonstrate a large, lobulated, solid-cystic mass involving the left cerebellopontine angle, extending into the left internal auditory canal and the left temporal region through the petrous temporal bone. She underwent microscopic resection, and histopathology confirmed schwannoma. Figure 1 d, e, f show T2-, T1-, and T1 post-contrast axial images demonstrates a small residual lesion along the left cerebellopontine angle with intracanalicular extension. This residual component could have been addressed with the aid of endoscopic assistance.

headache – likely due to less soft tissue disruption. These highlighting the minimally invasive advantage of the endoscopic technique.[1,6] These findings suggest that while core surgical outcomes remain equivalent, the endoscopic approach may offer advantages in early postoperative recovery and patient comfort.

Endoscopic-assisted microsurgery represents an important transitional technique, in which the endoscope is used adjunctively to overcome microscopic blind spots. This hybrid approach is more widely practiced than fully endoscopic surgery. Similarly, most available studies have evaluated endoscopic-assisted technique and very limited literature is available for fully endoscopic technique.[2,7]

One of the key limitations of microscopic retrosigmoid approach is its linear illumination which restricts visualization and access to the internal auditory canal (IAC) fundus and other hidden anatomical regions. Endoscopy addresses this by providing angled, panoramic views that minimize blind spots. This improved visualization facilitates greater tumour resection, particularly in intracanalicular components.[8] Supporting this, retrospective studies have demonstrated that endoscopic assistance improves the extent of tumour resection, particularly in lesions with intracanalicular extension, without compromising functional outcomes. In many cases, complete tumour removal required endoscopic visualization to identify residual tumour within the IAC.[9] Earlier series have similarly reported high rates of resection with improved visualization of critical neurovascular structures, reinforcing the role of endoscopy in enhancing surgical completeness.[10]

Nerve preservation:

Preservation of facial and cochlear nerve function remains a key determinant of postoperative quality of life. Both microscopic and endoscopic approaches achieve favourable outcomes; however, endoscopy may provide an advantage through improved visualization of the nerve-tumour interface.

A meta-analysis, though comparing endoscopic and open retrosigmoid approaches have reported higher rates of favourable facial nerve outcomes in endoscopic series (94% vs 67%).[11] Similarly, studies of endoscopic-assisted techniques have demonstrated good facial nerve preservation, particularly in tumours with intracanalicular extension, where visualization is a bit challenging. This approach, not only allows better visualization of blind spots but also of cochlear nerve and helps minimize traction – improving hearing outcomes.[12]

However, individual cohort studies including Lang et al. have not demonstrated statistically significant differences in hearing outcomes between techniques.[1] This suggests that factors such as tumour size, anatomical characteristics, and surgeon experience may play a more critical role than the visualization modality alone.

Overall endoscopic assisted microscopic surgery is an important transitional technique, addressing visual limitation of microscopy. Evidence indicates that while endoscopic assistance improves exposure and may enhance resection rates, its impact on functional outcomes remains variable. Fully endoscopic surgery represents a further evolution technique; however, its adoption is limited by equipment requirements and specialized expertise/.[10] Therefore, in many resource limited settings endoscopic assisted technique remains a more practical approach.

Conclusion

Endoscopic retrosigmoid surgery for vestibular schwannomas has emerged as safe and effective alternative or adjunct to conventional microscopic techniques. Current evidence indicates comparable outcomes in terms of preserving nerve functioning and complication rates. The main advantage of the endoscopic technique lies in minimally invasive nature and covering blind spot, which contribute to improved surgical precision and quality of life. Despite these potential benefits, the overall quality of evidence remains limited, and further prospective studies are needed to establish its definitive role in clinical practice.

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