Keyhole Retrosigmoid approach – surgical technique and technical nuances

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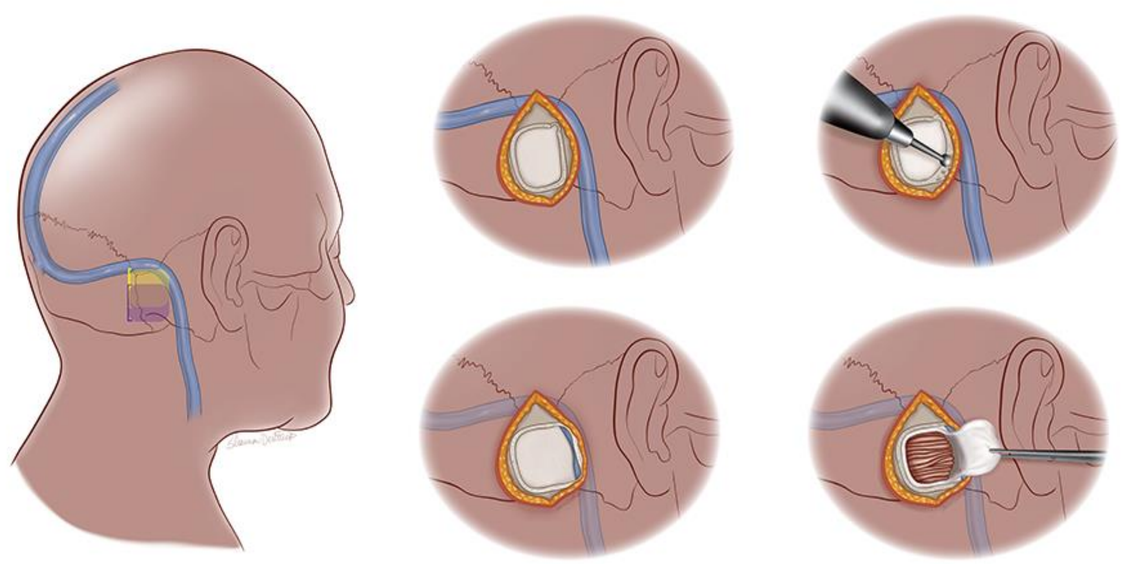
Introduction

The retrosigmoid craniotomy is a workhorse in skull base neurosurgery. Retrosigmoid craniotomy offers exposure to lesions in the cerebellopontine angle, lateral brainstem, internal auditory canal, petroclival junction and foramen magnum [1, 2]. Numerous variations of retrosigmoid approach craniotomies have been previously described [3-7]. Here, we describe our minimally access keyhole retrosigmoid approach (RSA) craniotomy. This approach was used to treat various pathologies ranging from microvascular decompression to resection of large cerebellopontine angle (CPA) tumors.

Methods and Materials

Cases performed by the senior author in first 18 months since the completion of his fellowship were reviewed. Surgical approach and outcomes were reviewed.
Surgical approach (Figure 1): Patients are placed in supine position on the OR table with or without without a shoulder bump. Pre-positioning and post-positioning somatosensory evoked potentials are obtained. The head is turned to the contralateral side and translated superiorly to clear the shoulders (Fig. 1). Neuro-navigation is used in all cases. Mannitol (0.5gm/kg) is used in all cases and it is administered at the time of the incision. A linear or slightly curvilinear incision is made two finger breadths posterior to the external auditory canal. The length of the incision ranges from 2-4 inches based on the proximity of the lesion to the surface. The rostro-caudal location of the incision is determined by the location of the pathology. Use of electrocautery is minimized to prevent damage to the muscle layers. Hooks are used retract the myocutaneous flaps medial and lateral. A single burrhole is made at the transverse-sigmoid junction. Using a craniotome, the bone flap is elevated. Further drilling is performed to expose at least 1/3rd of the sigmoid sinus. Transverse sinus exposure depends on the rostral location of the pathology and is usually performed along with the original craniotomy after careful extradural dissection. The dura is opened at the caudal end first, enough to pass a 1"x 3" cottonoid. The cerebellomedulary cistern is opened with sharp dissection to release cerebrospinal fluid. The remaining dura is opened in a C-shaped fashion with the base towards the sigmoid sinus. Fixed retractors are not used. The endoscope was frequently used to visualize the depth and corners of the resection cavity. Closure is performed either primarily or with the help of bovine pericardium. A piece of onlay dural substitute is placed. Bone is replaced to tamponade the closure. Circumferential bony defect is filled with Surgicel. Hemostatic sealants were not used. Wound is closed in a multi-layered fashion



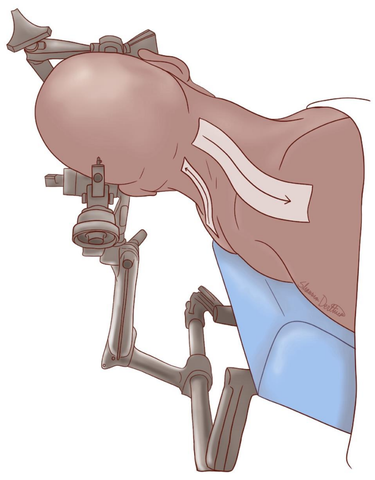


Figure 1: Schematic representation of steps for mini retrosigmoid craniotomy. Incision can be tailored according to the location of the pathology. Since all cases were performed in supine position, it is important to translate the head above the chest to clear the shoulder.

Results

Demographics	Indications	Outcomes
Gender: • **17 females** • **10 males** **Age:** • **Average 56** • **Range 28-77**	Schwannoma: 1. Vestibular (n=5) 2. Trigeminal (n=1) 3. Vagal nerve (n=1) Tumors: 1. Meningioma a) Petroclival (n=1) b) Petrous (n= 3) 1. Epidermoid (n=2) 2. Paraganglioma (n=1) Functional/Pain: 1. Trigeminal neuralgia (n=9) 2. Hemifacial spasm (n=2) 3. Hemifacial spasm and hemi-laryngospasm (n=1) 4. CPA arachnoid cyst (n=1) Range of size of lesions: 2 x2 mm - 4.5x 4 cm	Major complications (n=2): • House Brackmann (HB) 5 (n=1), resolved • HB 4 (n=1), resolved Minor complications (n=3): • HB 1 (n=1), resolved • CSF rhinorrhea and reoperation (n=1) • Hearing loss (n=1) Average length of hospital stay: 2.4 days

Figure 2: Outcomes from twenty-seven consecutive patients who underwent minimally invasive keyhole RSA craniotomy.

Discussion

With this minimally invasive keyhole RSA craniotomy we were able to treat 27 patients with various pathologies and presentations. One of the major concerns with retrosigmoid approaches is the development of cerebrospinal fluid (CSF) leak and pseudomeningocele formation. In our case series none of the patients suffered from such complications. We believe that small incisions, detailed dural closure (either primarily or with onlay dural substitute), replacement of bone and multi-layer would closure are crucial for these results. Hemostatic sealants were not used in any of the cases. Even though the length of the incision ranged from 2-4 inches, we were able to remove lesions that ranged from 2 x2 mm to 4.5 x 4 cm. In certain cases, the endoscope had to be used to gain access to deeper portions of these lesions. We recognize that the limitation to our approach is that it is based on a keyhole concept. Use of endoscope is essential in majority of the cases.

Conclusions

This minimally invasive keyhole and retractorless approach provides adequate exposure to manage large tumors. In addition, this approach offers excellent cosmetic results. The use of endoscope is sometimes necessary to achieve adequate resection. Familiarity with surgical anatomy and comfort with working in a small surgical corridor is essential.

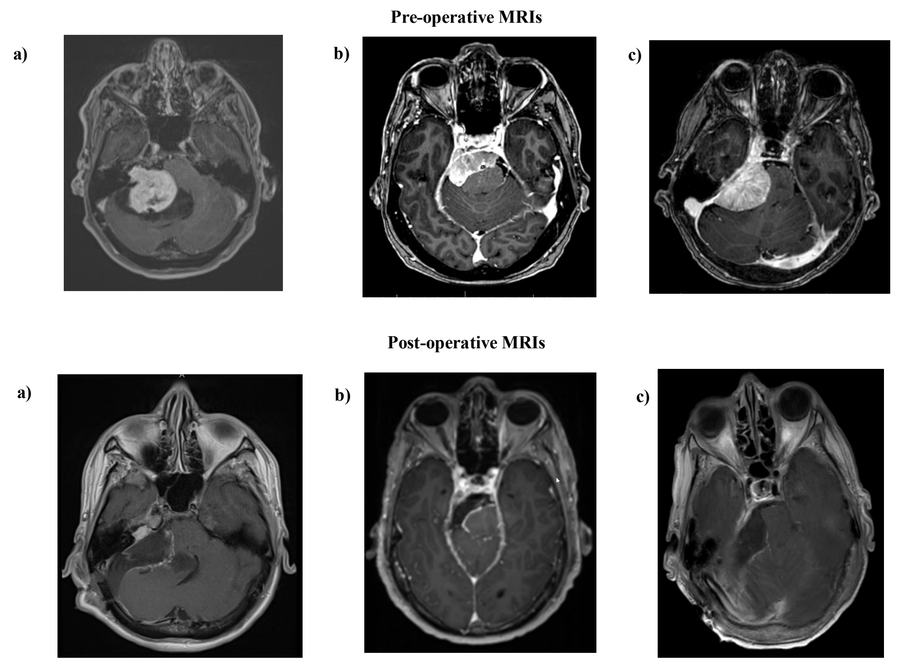


Figure 3: Sample of pre-operative and post-operative MRIs from different patients who underwent minimally invasive keyhole RSA craniotomy.

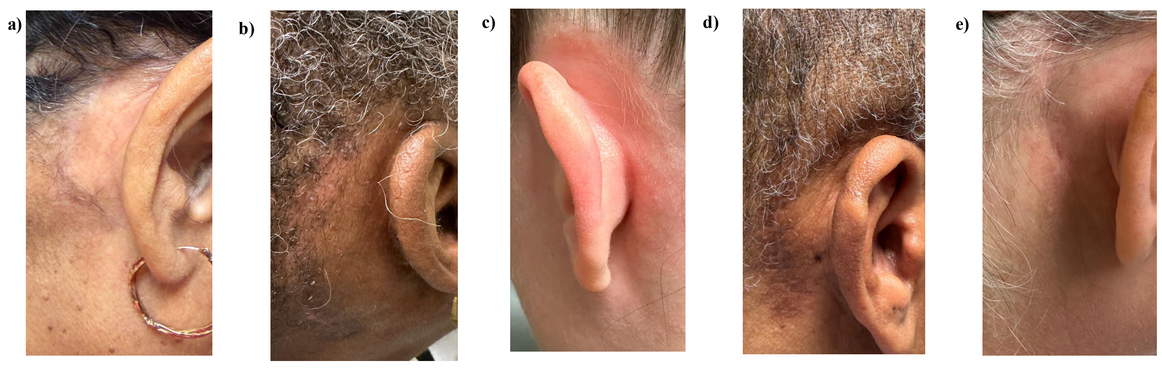


Figure 4: Post operative incisions from mini retrosigmoid craniotomy

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