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Case Report

Parietal transventricular approach for medial temporal glioma: A technical report

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ABSTRACT

Background: Medial temporal lobectomy (MTLy) poses a surgical challenge due to convoluted anatomy of medial temporal lobe (MTL). Various approaches have been described to access MTL for removing various pathologies. We, hereby, describe the parietal transventricular approach for removing a concurrent medial temporal glioma in a patient with recurrent parietal glioma.

Case Description: A 40-year-old female operated and diagnosed case of the right parietal anaplastic astrocytoma presented to us with a recurrence in parietal region. In addition, a fresh lesion was observed in the right MTL suggestive of a separate temporal glioma. The patient underwent excision of both parietal and temporal gliomas through the parietal approach only. Complete excision of parietal recurrence and near-total excision of medial temporal glioma was achieved.

Conclusion: The parietal approach can be used for excision of medial temporal lesions, especially those involving or extending into its posterior limits. In the presence of concurrent parietal and MTL lesions, both lesions can be removed through a single parietal approach rather than a separate approach for MTLy. It offers additional advantages of the preservation of optic radiations as well as the temporal neocortex. The visual orientation of MTL structures is different when viewed from the parietal approach as compared to the temporal approaches. The parietal approach provides in line orientation of medial temporal structures contrary to the perpendicular orientation visualized in temporal approaches. An understanding of MTL anatomy as viewed from a parietal vantage point and its three-dimensional conceptualization is very important to successfully remove lesions of MTL through the parietal approach.

Keywords: Glioma, Medial temporal lobectomy, Parietal transventricular approach

INTRODUCTION

Medial temporal lobectomy (MTLy) is performed for various indications, most commonly for temporal lobe epilepsy and tumors of medial temporal lobe (MTL). MTLy has posed challenges to neurosurgeons as MTL is a complex convoluted structure. Several approaches have been described for accessing and removing lesions of MTL.[3,4,6-11,14,15,17] In this report of a recurrent parietal glioma with concurrent ipsilateral medial temporal glioma, we describe the excision of the medial temporal glioma through the parietal transventricular approach (PTVa). The challenge in removing medial temporal glioma, through a posterior approach, was posterior to anterior orientation of medial temporal structures along the axis of hippocampus/parahippocampus gyrus as compared to the more familiar visual orientation in standard approaches, that is, perpendicular to the axis of medial temporal structures. The purpose of this report is to present the MTL anatomy as visualized from a different and unfamiliar vantage point. The steps of approach and the difficulties encountered while performing the procedure are discussed.

CASE REPORT

A 40-year-old female operated and diagnosed case of the right parietal anaplastic astrocytoma presented to us with recurrence of symptoms after being lost to follow-up after the first surgery performed 1 year back. The latest magnetic resonance imaging (MRI) revealed a recurrence in the parietal region that was reaching up to the ventricular surface. Apart from the parietal lesion, a fresh signal change could be observed in the right MTL suggestive of a separate temporal glioma [Figures 1a-h]. The surgical options included excision of parietal recurrence through the previous incision and removal of temporal glioma through a separate temporal approach [Figure 2a] or excision of both the lesions through PTVa using the previous incision [Figure 2b]. It was decided to excise both the lesions through PTVa only. Apart from the advantage of targeting both lesions through a single approach, there was an added advantage of lesser chances of developing visual field deficits through PTVa. The preservation of temporal neocortex was another added advantage.

The patient was positioned prone with head turned slightly toward the right side. Through the scalp incision, the previous parietal craniotomy flap was raised. The parietal tumor was completely resected. At the end of the resection of parietal tumor, the ventricular cavity was entered as the tumor was extending till and bulging into ventricles. The retraction was applied using the Leyla retractor system so as to get a view of the atrium and the temporal horn. The normal anatomical landmarks, including thalamus, choroid plexus, fimbriae, and body of fornix, were identified. There was no continuity between the parietal and medial temporal tumors confirming the two being concurrent tumors. The enlarged hippocampus was seen along its entire length, except the region of amygdala, that was not in the line of vision. The orientation of hippocampus/parahippocampus was along its anteroposterior axis [Figure 3a]. The choroid plexus at the posterior limit of resection was reflected medially and fimbriae were dissected to expose the hippocampal fissure [Figures 3b and c]. The posterior disconnection was then performed at the posterior-most extent of the tumor. As the hippocampus/parahippocampus was bulky, the tumor was debulked using a Cavitron ultrasonic aspirator. The tumor decompression was done both superior and inferior to the hippocampal fissure to remove completely both hippocampus and parahippocampal gyri, taking care not to breach the arachnoid medially. The dissection was advanced gradually anteriorly. As the tumor was debulked, the choroid plexus just anterior to the already removed hippocampus was reflected medially and the fimbriae were dissected to expose the immediate anterior part of the hippocampal fissure and further tumor debunking was done both superior and inferior to the hippocampal fissure. In this manner, the hippocampus/parahippocampus with the tumor was completely removed except for a tumor involving the amygdala that was hidden from view and was inaccessible through this approach [Figure 3d]. Hemostasis was achieved. The patient

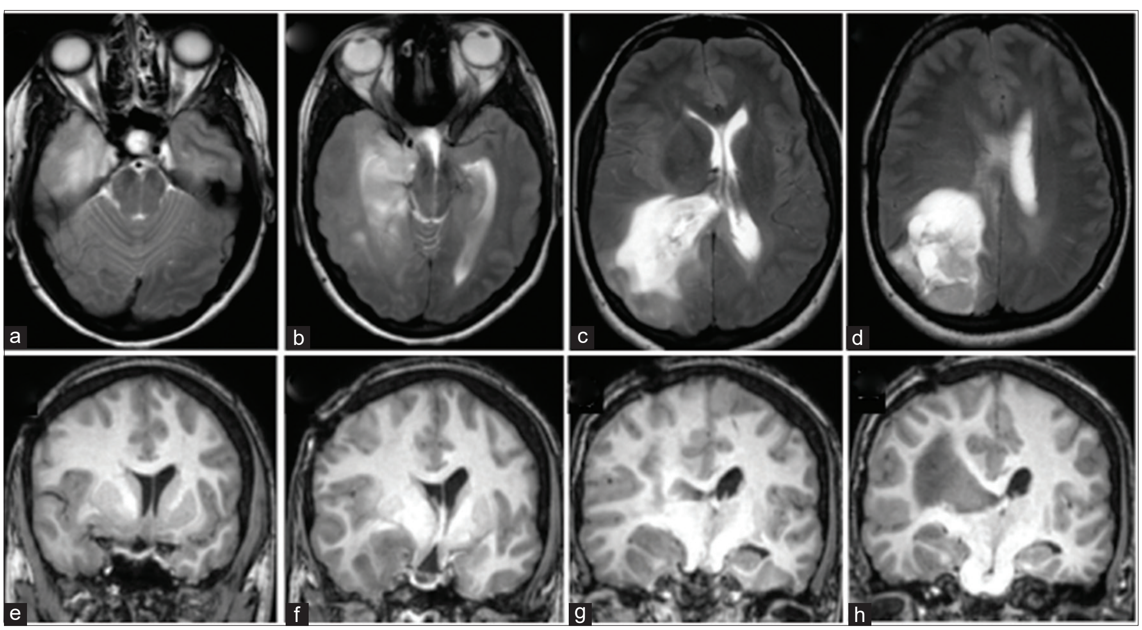

Figure 1: Preoperative magnetic resonance imaging images. Axial (a-d) and coronal (e-h) images show a lesion hyperintense on T2-weighted (T2W) images and isointense on T1-weighted (T1W) images, involving the right medial temporal lobe (a, b, and e-h) and large recurrent tumor involving the right parietal region (c and d).

made an uneventful recovery without any postoperative deficits. Postoperative imaging revealed complete excision of the parietal tumor and near-total excision of the medial temporal tumor with a residual tumor only in the region of superomedial amygdala [Figures 4a-h].

DISCUSSION

MTLy has been considered a challenging procedure. The convoluted anatomy and long anteroposterior dimensions of medial temporal structures with associated two bends along with the midbrain and petrous pyramid are the factors responsible for the complexity associated with surgery of this region. For this reason, it is also difficult to approach the entire length of medial temporal structures with a single approach.[9] It was only after Yasargil published a report on successful microsurgical management of limbic and paralimbic tumors in the early 1980s that the neurosurgeons started performing this procedure.[9,17,18] After this report, the anatomy of the mediobasal temporal lobe has been extensively studied and many reports on surgical management of these tumors have been published.[1,2,5,12,13] Yasargil had classified limbic and paralimbic tumors based on the embryological development of the brain.[16] Schramm and Aliashkevich[7] published a large series of mediobasal temporal tumors and proposed a classification as a practical tool to guide the surgical approaches to these tumors. They first divided the medial tumors into anterior and posterior types using the point of the widest diameter of the brainstem pentagon on axial MRI. Type A tumors lie medial to collateral and lingual sulci and involve the amygdala, hippocampus, and parahippocampus. Type B tumors lie lateral to Type A tumors and involve the fusiform gyrus and inferior temporal pole lateral to uncus. Type C tumors involve the combined area of Types A and B

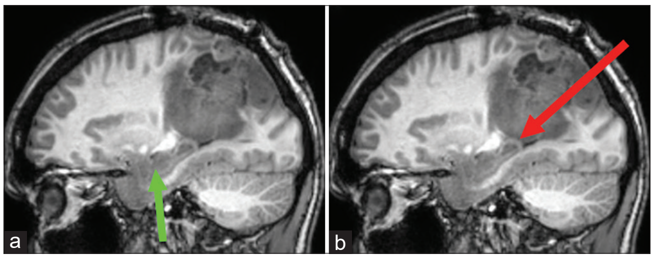

Figure 2: Comparison of the surgical trajectories when accessing the temporal lesion through separate temporal approach (green arrow in a) as compared to the trajectory when the temporal lesion was accessed through parietal approach (yellow arrow in b), as was done in the present case.

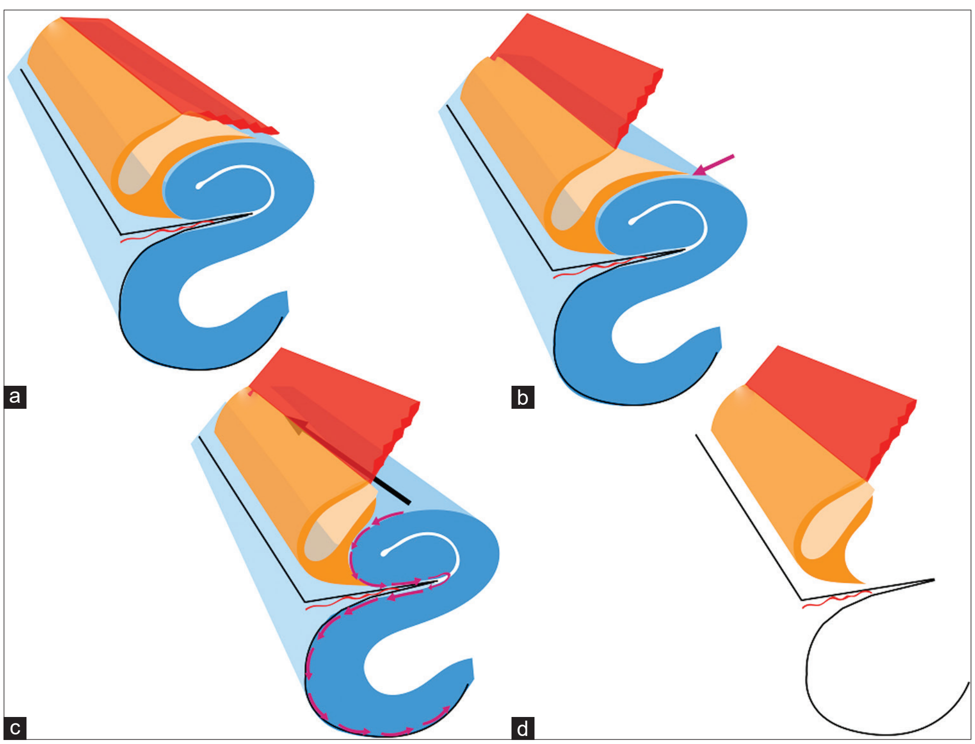

Figure 3: Diagrammatic illustration of the right medial temporal anatomy and the procedure of medial temporal lobectomy (MTLy) when performed through parietal transventricular approach. The hippocampus/parahippocampus (blue) is visualized in an anteroposterior orientation in this approach (a). The choroid plexus (red) is reflected medially followed by dissection (purple arrow) of fimbriae (yellow) away from hippocampus (b). The dissection then proceeds along with the surface of hippocampus and parahippocampus (serial purple arrows in c) to separate them from the hippocampal fissure pia/arachnoid. These steps are repeated and dissection proceeds in anterior direction (black arrow in c) to complete the MTLy (d).

and are bounded by occipitotemporal sulcus laterally. Type D tumors involve the temporal stem and/or insula and lateral basal ganglia and are thus high surgical risk tumors. The four tumor types can be either anterior (a), posterior (p), or both anterior and posterior (a+p). The tumor in the present case belonged to Type C (a+b).

Various approaches that are used for accessing the MTL include transsylvian, anterior two-third temporal lobe resection, subtemporal, and transcortical.[3,4,6-11,14,15,17] These are the standard approaches for accessing the MTL structures. The other approaches that have been described for MTL lesions are supracerebellar transtentorial (SSTT) approach for accessing the posterior MTL region.[19] The anterior approaches, whether transcortical, transsylvian, or subtemporal, provide a visual orientation, in which medial temporal structures are perpendicular to the line of vision and one can visualize the regions of anterior and posterior disconnection almost simultaneously [Figure 5].

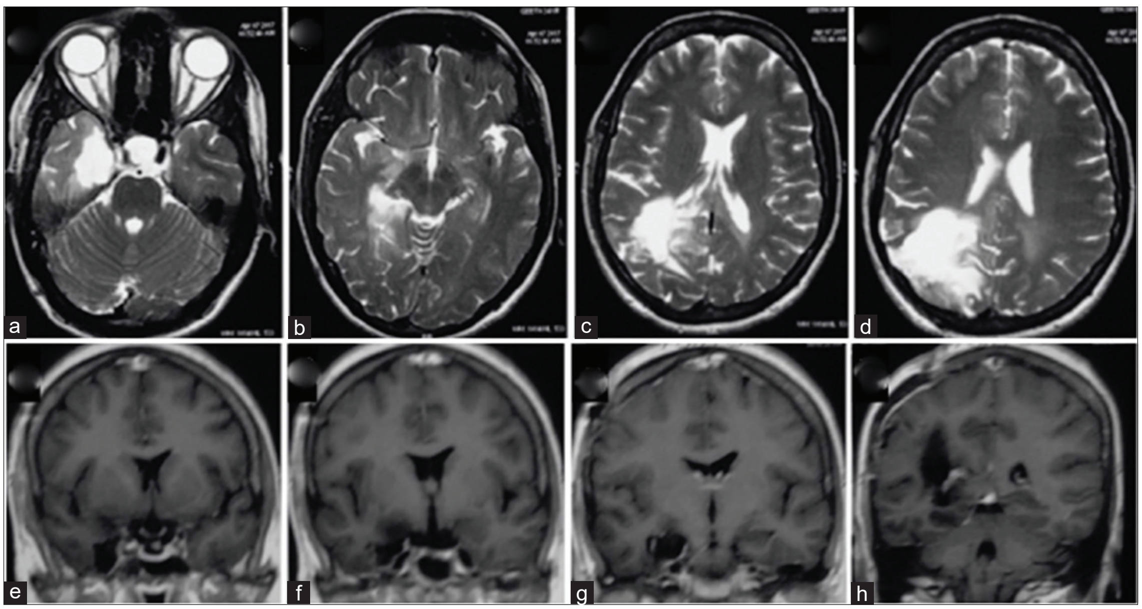

Figure 4: Postoperative T2W axial (a-d) and T1W coronal (e-h) images reveal total excision of parietal glioma (a-d) and near total excision of medial temporal glioma except the tumor in the region of amygdala (b and f).

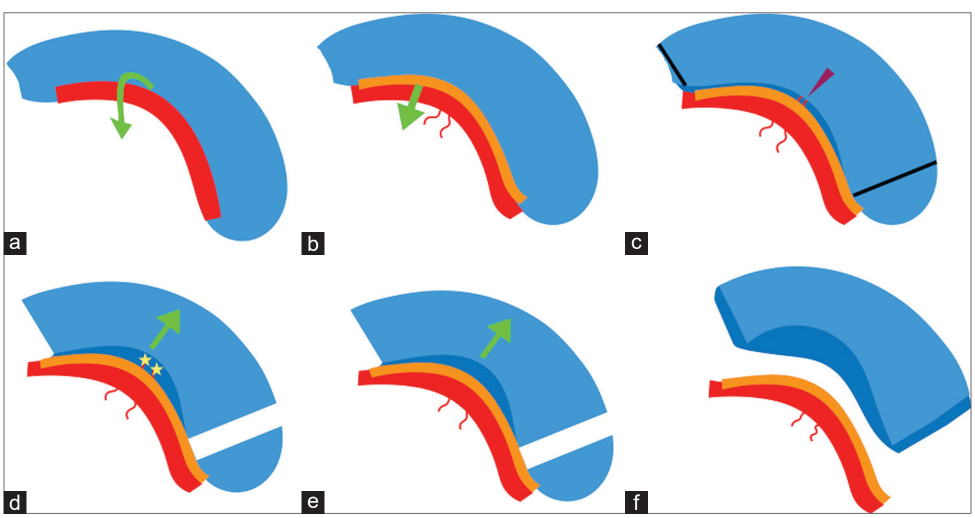

Figure 5: Diagrammatic illustration of the right medial temporal anatomy and the procedure of medial temporal lobectomy (MTLy) through temporal approach. The hippocampus (blue) is visualized in a perpendicular orientation to visual trajectory (a). The choroid plexus (red) is reflected medially (curved green arrow in a). The dissection of fimbriae (orange in b) reveals the hippocampal fissure with hippocampal vessels (purple arrowhead in c). Anterior and posterior disconnections (black lines in c) are then made. After dissection of hippocampus/parahippocampus from hippocampal fissure and surrounding pia/arachnoid, the MTLy specimen is then removed (d-f). Yellow oval represents amygdala.

In this report, the author describes MTLy performed through a PTV route. This approach was chosen in this particular case because the atrium of the lateral ventricle was made accessible by the parietal tumor extending from the cerebral to the ventricular surface. The patient had no visual field deficits preoperatively, suggesting the displacement of optic radiation fibers. There was thus a possibility of preserving the optic radiations if the tumor was approached through the parietal route as compared to the standard anterior temporal approaches that are associated with a significant risk of injury to optic radiation with consequent field cuts.[3] The patient did not develop any field cuts postoperatively. However, this approach did pose technical challenges as it offers a different perspective of the anatomical orientation and visualization of medial temporal structures as compared to anterior approaches [Figures 3 vs. 5]. The medial temporal structures lie along with the line of vision of surgeon in this approach [Figure 3a], and thus, the regions of anterior and posterior disconnections cannot be simultaneously visualized. One has to work one's way through the hippocampus/parahippocampus gyrus to reach the anterior-most part. The challenge is also posed by the anterior bend of MTL across the brainstem, making this region partially invisible. The working distance till anterior most limit is also relatively longer, but with maneuvering of the microscope, dynamic retraction, and using longer instruments, it was possible to reach until temporal pole [Figure 1e] and completely removes the MTL through this approach except the tumor involving the superomedial part of amygdala [Figures-1e, f, and m-o]. As compared to SSTT approach, PTVa offers a shorter and more cranial and medial trajectory and thus provides a better visualization of almost entire length of medial temporal structures and it avoids the drawbacks of SSTT approach including sitting position with its anesthetic complications, need of cerebellar retraction, and inaccessibility of anterior part of MTL.

CONCLUSION

PTVa can be used for excision of medial temporal lesions, especially those involving or extending into its posterior limits. In the presence of concurrent parietal and MTL lesions, both lesions can be removed through a single parietal approach rather than a separate approach for MTLy. It offers additional advantages of the preservation of optic radiations as well as temporal neocortex. The visual orientation of MTL structures is different when viewed from PTVa as compared to the temporal approaches. The PTVa provides in line orientation of medial temporal structures contrary to the perpendicular orientation visualized in temporal approaches. An understanding of MTL anatomy as viewed from a parietal vantage point and its three-dimensional conceptualization is very important to successfully remove lesions of MTL through the parietal approach.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Conflicts of interest

There are no conflicts of interest.

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