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Case Report

Microsurgical and endoscopic-assisted supraorbital keyhole approach for intra-suprasellar cysticercosis

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ABSTRACT

Background: Treatment for intra/suprasellar cysticercosis can be challenging and may result in visual disturbances if not managed properly. Despite its limited knowledge, an effective surgical option exists to treat this condition. This article presents three cases of sellar cysticercosis, comprising one female and two male patients, managed with microsurgical supraorbital keyhole approach (mSKA) and endoscopic-assisted supraorbital keyhole approach (eaSKA).

Case Description: The first patient is a 35-year-old man with no prior medical history who suffered from memory deficits and visual disturbances due to a sellar cyst pushing the orbitofrontal gyrus treated with mSKA. The second case involved a 52-year-old man who experienced visual deficits caused by a rostral sellar cyst with posterior displacement of the pituitary gland treated with eaSKA. The third case was a 46-year-old woman who experienced decreased visual acuity and memory loss due to multifocal neurocysticercosis (NCC) with sellar-suprasellar cyst extension treated with mSKA. All case diagnoses were confirmed by neuropathology department.

Conclusion: The authors confidently suggest that the SKA is an effective surgical option and could be considered for removing sellar cystic lesions with suprasellar extension. With endoscopic assistance, it improves adequate neurovascular structure visualization.

Keywords: Intrasellar/Suprasellar, Neurocysticercosis, Supraorbital keyhole approach

INTRODUCTION

Neurocysticercosis (NCC) is an infection in the central nervous system (CNS) caused by *Taenia solium*. This disease is common in developing countries, particularly in Latin America, Asia, and sub-Saharan Africa.[5,7,9] NCC can imitate different neurological diseases.[6,21,22] It primarily targets the brain parenchyma, ventricular system, and subarachnoid space, despite its potential to impact other areas of the body.[6] In particular, the sellar and suprasellar regions are rarely affected.[7] The inadequate management for this area can spread to other compartments, resulting in a worse prognosis with increased rates of mortality and morbidity.[4,5,8,12] Intrasellar cysticercosis cannot be adequately treated with cysticidal drugs alone and may even exacerbate some comorbidities. For this location, timely surgical intervention must be considered.[7,24]

Fortunately, with the emergence of minimally invasive techniques, and perceptive instrumentation, it has become feasible to treat lesions in this area.[20,27] This article presents senior authors' experience using the microsurgical supraorbital keyhole approach (mSKA) and

endoscopic-assisted supraorbital keyhole approach (eaSKA) for sellar-suprasellar parasitic cysts.

CASE DESCRIPTION

This study was conducted at Hospital Juárez de México from January 2001 to February 2021. We examined the medical records of patients diagnosed with NCC, with selection criteria focusing only on patients with intrasellar NCC treated with the SKA. Patients who received treatment elsewhere or had surgical procedures were excluded from the study. Our database revealed three patients with intrasellar cysticercosis approached with mSKA, and eaSKA. NCC diagnosis was confirmed by the neuropathology department.

Case 1

A 35-year-old male patient presented with emotional instability, memory loss, headaches, and changes in vision over the past month. Further, neurological examination revealed limited peripheral vision with decreased visual acuity. Hormonal tests were normal. Magnetic resonance imaging (MRI) scan showed a cystic lesion in the sellar region extending to the suprasellar area [Figure 1]. Minimal edema was observed on fluid-attenuated inversion recovery (FLAIR) imaging. For this case, the patient was approached through mSKA treatment due to the location in the sellar region and mesial suprasellar area.

The patient was placed in a supine position, with contralateral 10° rotation, accompanied by slight elevation and extension of the head. The incision was performed over the eyebrow through the supraorbital rim with the temporalis muscle detached. A simple burr-hole was performed slightly below the junction of the superior temporal line-orbital rim. Before accessing the dural aperture during intracranial surgery, drilling the frontal eminences was an essential step to gain proper exposure and visualization. Dura was opened in the usual fashion. The next step involved opening cisterns to drain cerebrospinal fluid (CSF) to minimize frontal lobe retraction and maximize frontal lobe drop. A cyst was encountered during the procedure with slight arachnoid adhesions in the mesial frontal lobe and optic chiasm. During the surgery, one of the cysts was accidentally ruptured, and it was managed using an aspirator to trap the defect, followed by retraction of the compartmental cysts. This effectively minimized the spill-out and reduced the risk of arachnoiditis [Figure 2].

It was crucial to administer dexamethasone 8 mg once a day during and after the surgery. This treatment lasted for 72 h, and then, the patient took oral steroids accompanied by oral albendazole for 21 days. The pathology sample confirmed the diagnosis [Figure 3]. The patient's visual deficit improved during the 6-month follow-up, and no other clinical manifestations were observed.

Case 2

A 52-year-old man, who had a long-term history of diabetes, began experiencing a gradual loss of vision over the past 4 months. On the clinical examination, it was discovered that he had slightly restricted peripheral vision. An MRI revealed a lesion in the sellar location with a small extension in the subchiasmatic and prechiasmatic areas. An endoscope was used to amplify the corridor to reach the affected region, visualize the cyst, and perform the necessary dissection.

For this case, a microscope and a rigid endoscope with lenses 0° and 30° were utilized. We followed the previously described approach, exposing the cyst and dissecting it under the optic nerve. Bayonet forceps were used for slight traction, resulting in a minor cyst spill. To aid in dissection, we re-introduced the endoscope and carefully retracted the cyst. During the process, we observed a yellowish punctate hemorrhage and rubberized consistency [Figure 4].

The patient was under dexamethasone and albendazole for 21 days, following the same procedure as the previous case. The pathology department confirmed the diagnosis

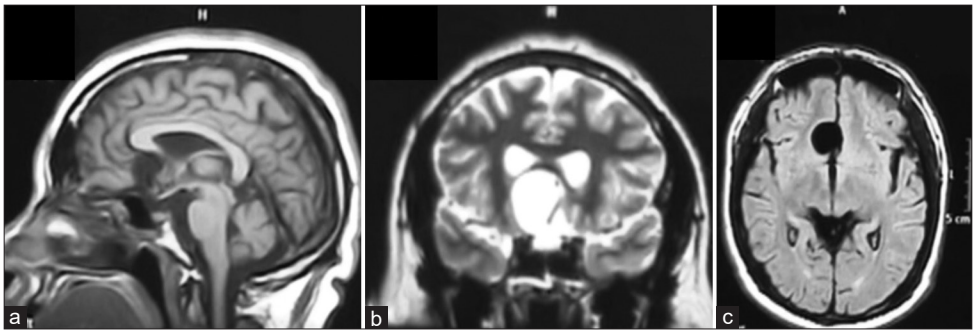

Figure 1: Magnetic resonance imaging study of case 1. (a) T1-weighted sagittal plane, hypointense lesion in the sellar region with extension to the suprasellar area adjacent to the mesial frontal area. (b) T2-weighted coronal plane shows the consistency of cystic lesion, (c) with minimal perilesional edema in axial fluid attenuated inversion recovery image.

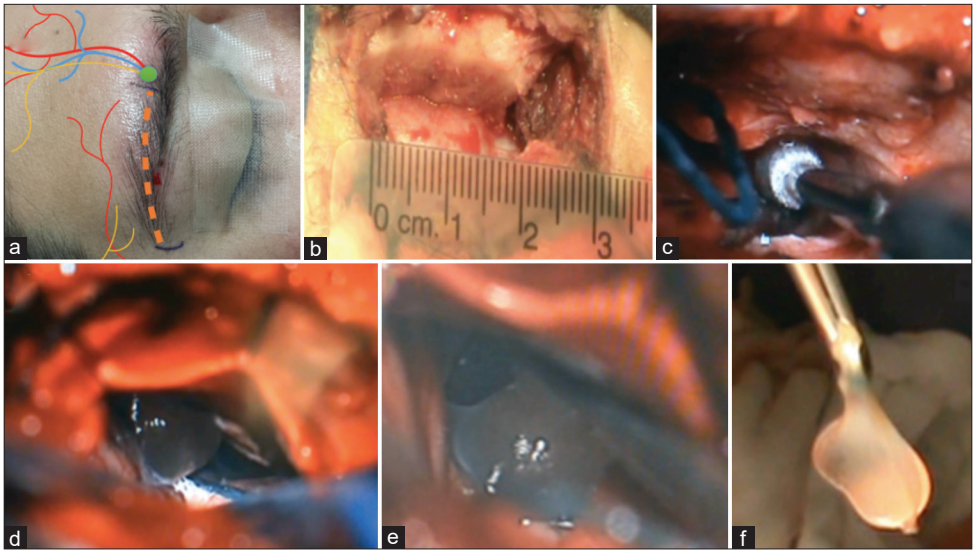

Figure 2: Microsurgical supraorbital keyhole approach of case 1. (a) Planned eyebrow incision preserving the marked neurovascular structures (orange dotted line). Green dot represent the supraorbital foramen. (b) A small craniotomy was performed in relation to the supraorbital ridge, approximately 3 cm × 3 cm. After dural retraction of the frontal dura, (c) drilling of the frontal eminences with a diamond drill tip to gain more exposure, the dural leaflet was tacked up, (d) visualization of the cyst, and (e) adequate dissection of the cyst, preserving the planes of the capsule cyst to avoid its rupture. (f) The cyst was resected.

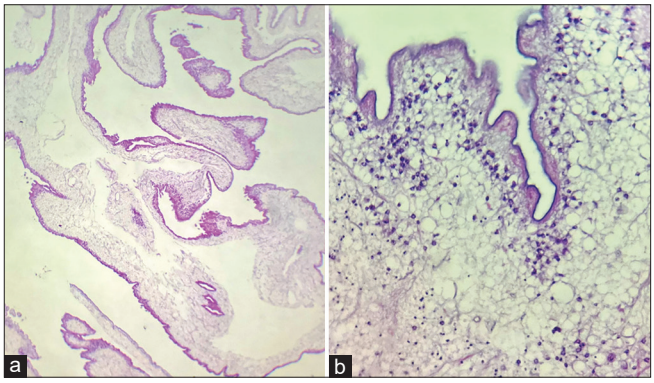

Figure 3: Histopathological findings of case 1. (a and b) Hematoxylin and eosin stain ×10 and ×40. Microscopic images showed the parasitic wall wavy with aggregated subcuticular cells and smooth muscle fibers, with surrounding inflammatory, mononuclear lymphocytic reaction.

[Figure 5]. After 9 months of follow-up, the patient persists with some visual acuity deficit.

Case 3

A 46-year-old woman presented with progressive headaches, an unsteady gait, and dorsolateral frontal syndrome over the past 5 months. Her symptoms have worsened over the past 3 weeks, including visual loss and tonic-clonic seizures. Clinical examination revealed decreased visual acuity, altered executive function, and memory loss. MRI scans confirmed multifocal NCC in the temporal and frontal

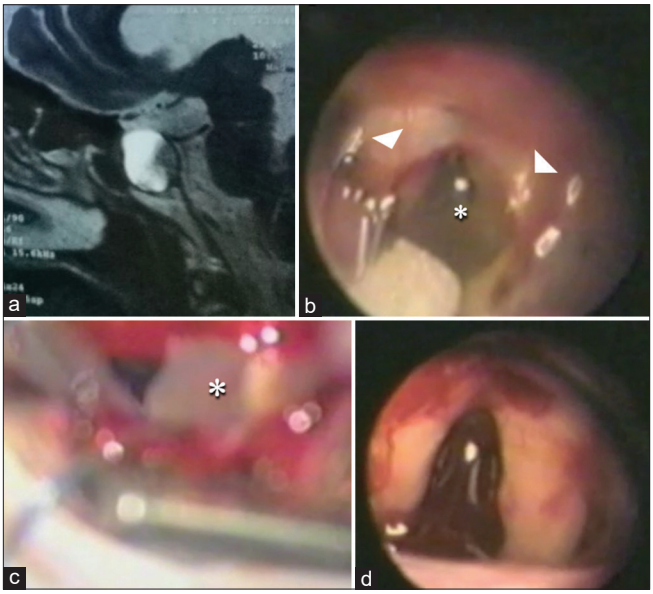

Figure 4: Magnetic resonance imaging (MRI) and surgical resection with endoscopic-assisted supraorbital keyhole approach of case 2. (a) MRI, T2-weighted sagittal plane shows sellar cyst with slight suprasellar extension. (b) The endoscope is introduced for endoscopic assessment of the cyst (an asterisk marks the intrasellar parasitic cyst, and head arrows mark the optic nerves). (c) Resection of the cyst with rongeurs under microscopic visualization (asterisk select the cyst), and (d) reassessment of the sellar area.

lobes, with compromise in the sellar-suprasellar area. The mSKA procedure was successfully performed as the first case

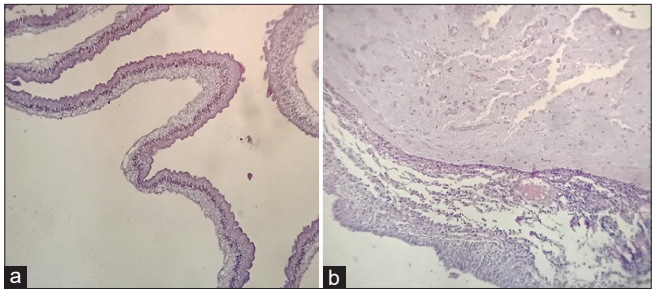

Figure 5: Histopathological findings of case 2. Under high magnification, ×10, and ×40. (a and b) Histopathology of the cyst showed three layers (cuticular, cellular, and reticular). Gliosis around parenchymal cysticerci, with granulomatous reaction with epithelioid cells and foreign body giant cells.

technical description, with pathological findings consistent with NCC. In the postoperative, the patient received steroids and albendazole for 21 days, complemented with an anticonvulsant. After 3 months of follow-up, the patient reported improved visual acuity. At 12 months, the patient recovered her paresis in the leg and her visual acuity.

DISCUSSION

In this study, we described the surgical treatment for three cases of cysticercosis located in the sellar/suprasellar region using microsurgical and endoscopic-assisted SKA. The rarity of cysticercosis in the sellar location has led to a lack of established treatments.[7] As far as we know, this is the largest series treated with SKA for parasitic cysts in this location.

Helminthic infections in the CNS are commonly caused by NCC and have become a major public health problem. Approximately 50% of NCC in the sellar area may manifest as a solitary cyst. The other cases typically involve either extra sellar or disseminated CNS involvement.[7] Despite the advent of neuroimaging studies to facilitate the diagnosis of NCC,[19] helminthic cysts in the sellar region can result in serious neurological deficits. These cysts have the potential to compress the optic nerves, pituitary stalk, and pituitary gland, leading to a variety of ophthalmological and endocrinological symptoms. In cases of subarachnoid cysticercosis, anthelmintic treatment may trigger an inflammatory response due to parasite disruption, leading to potential damage to blood vessels and nerve entrapment. As a result, removing the cyst can become quite challenging.[7,12,22]

The treatment of sellar/suprasellar NCC has not been adequately discussed, and the available information regarding surgical treatment options for intrasellar cysticercosis is scarce. Surgical treatment has proven more effective than medical therapy for these lesions. Therefore, the recommended course of action is the surgical removal of the cysticerci.[5,21,24]

The advancements in microsurgery have made it possible to offer various surgical options for pathologies affecting sellar, parasellar, and anterior cranial fossa locations.[5] The pioneering works of Krause and Frazier, as well as Pernezcky's for SKA, have paved the way for these breakthroughs.[10,11,20] There are different methods to treat cysts in this area, but they all come with the risk of some complications compared to SKA.[1,17] This can lead to increased chances of diabetes insipidus, CSF fistula, hypopituitarism, as well as esthetic and rhinonasal complications.[1,2,14,18]

The supraorbital approach is an adequate alternative for anterior skull base lesions in sellar, parasellar, and suprasellar areas. This involves a limited incision with minimal tissue manipulation and minimizes the frontal lobe retraction, with subsequent decreased pain and rapid healing instead of conventional approaches.[16,17,25] In our opinion, SKA is an excellent option for treating lesions in the prechiasmatic and suprasellar areas because it provides a clear and direct view of the neurovascular structures.

There are some drawbacks to using mSKA, including the risk of hypoesthesia and eyebrow alopecia that can be prevented with gentle manipulation of the tissue and avoiding overuse of the monopolar during the initial stages of the approach. SKA can also be limited by extensive frontal sinus pneumatization and lesions below the sphenoid wing.[16] Furthermore, retrochiasmatic lesions may pose potential complications when using SKA, and hence, a different approach (pterional or endonasal endoscopic approach), may be required.[17] An additional inconvenience is the light found through such a corridor for mSKA,[17] as we specify for the second case. The assistance of an endoscope avoids the shadow,[27] and the illumination angles are corrected to aid in cystic capsule removal. Here, it is important to have adequate neurovascular visualization of the infrachiasmatic location. This tool assists during the surgery to better focus the lesion instead of a microscope alone.[17] Even it can reach the pituitary fossa, the interpeduncular cistern, the anterior third ventricle, and a portion of the middle fossa.[25]

In vascular pathology or large solid lesions, a different approach is mandatory to achieve better exposure and vascular control. The angle view in SKA can be challenging, making it difficult to visualize adjacent structures in the blood field, particularly in cases of massive brain edema.[15,17] In addition, some restrictions may be on handling surgical instruments during the procedure.[15,16] It should be mentioned that the cases being presented involve cysts with extensions into the sellar and suprasellar areas, and the authors did not encounter such a limitation.

The rupture of the helminthic cyst does not typically result in adverse complications or meningitis.[4,23] However, high mortality and morbidity rates are still associated with arachnoiditis and aseptic meningitis,[3] particularly in the

sellar-suprasellar area. To decrease these risks, it is essential to use a continuous irrigation saline solution and steroids particularly during, and after surgery, accompanied with anthelmintic treatment.[12,13] The clinical treatment results were favorable, particularly when surgery was performed promptly, and chronic arachnoiditis in this area may have a low likelihood of functional recovery.[3]

The mSKA and eaSKA methods could have similar effectiveness with several approaches,[14] but each case needs to be individualized. In this scenario, the cases solely involve cystic lesions in the sella that extend to the suprasellar region. One crucial aspect to consider is the surgeon's experience level and familiarity with the chosen approach.[25] This can greatly impact the quality of clinical outcomes. The most important factor for each surgery depends on the skills of the neurosurgeon,[15] with adequate knowledge of anatomy and not merely on which approach is the best. When considering the keyhole concept for treating pathologies, it is important to tailor the approach based on the specific type of pathology. It is also important not to overuse the Yasargil concept of minimizing parenchyma invasion by making the craniotomy size too small.[26] The cases here presented involve helminthic cystic lesions that required minimal manipulation of the parenchyma and the adjacent neurovascular structures, and not merely the craniotomy size.

CONCLUSION

Prompt surgical resection of intra/suprasellar cysticercosis may result in the resolution of clinical symptoms. For a predominance sellar lesion, eaSKA is recommended; this allows a better understanding of the configuration of the cystic capsule and the adjacent neurovascular structures. It is crucial to avoid incidental rupture of the capsule by applying continuous traction during aspiration to reduce the inflammatory reaction, in addition to medical treatment with steroids and anthelmintics (this last is not advisable to administer before the surgery).[13] We believe that mSKA and eaSKA are effective treatments for cystic lesions in the sellar-suprasellar area, and each case should be evaluated individually depending on the extension of the lesion, the availability of the endoscope, and the familiarization of the neurosurgeon with the SKA.

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Declaration of patient consent

Patients' consent not required as patients' identities were not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The author(s) confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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