



Original Article

Intracranial epidermoid cysts: Demographics, surgical strategies, and postoperative outcomes in a retrospective cohort study

Moneer K. Faraj

Department of Surgery, College of Medicine, University of Baghdad, Baghdad, Iraq.

E-mail: *Moneer K. Faraj - drmkfaraj@gmail.com



***Corresponding author:**

Moneer K. Faraj,
Department of Surgery, College
of Medicine, University of
Baghdad, Baghdad, Iraq.
drmkfaraj@gmail.com

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ABSTRACT

Background: Intracranial epidermoid cysts are infrequent, benign, and slow-growing lesions derived from ectodermal vestiges. Although extremely uncommon, these lesions represent a great challenge from a diagnostic and surgical point of view because they are located close to major neurovascular structures with great potential for complications. Our work aims to analyze demographic, clinical, radiological, and surgical features in patients with intracranial epidermoid cysts and to assess post-surgical outcomes to define better management strategies.

Methods: We conducted a retrospective cohort study of patients diagnosed with histologically confirmed intracranial epidermoid cysts and treated surgically at Dr. Said Al-Witry's Neuroscience Hospital from January 2020 to September 2024. Demographic data, clinical presentations, imaging findings, surgical approaches, and postoperative complications were analyzed using descriptive statistics and Chi-square tests. Statistical significance was set at $P < 0.05$.

Results: Out of 40 patients, 75% were male, with headaches being the most common symptom (50%). Magnetic resonance imaging (MRI) findings demonstrated T1 hypo-intensity in 95% and T2 hyper-intensity in all cases. The retrosigmoid approach was the most frequently employed surgical method (60%), followed by frontotemporal (30%) and midline suboccipital (10%) approaches. Postoperative complications occurred in 35% of cases, including facial nerve palsy (15%), aseptic meningitis (10%), cerebrospinal fluid leaks (5%), and hydrocephalus (5%). Chi-square analysis showed significant associations between surgical approaches and postoperative complications ($P = 0.048$).

Conclusion: Intracranial epidermoid cysts show a high incidence in males and present mostly with nonspecific symptoms such as headaches and seizures. MRI remains the key investigation modality. The retrosigmoid approach shows less complication rate when compared to other techniques. Even though surgery has evolved, complications such as meningitis and nerve palsy persist, so much attention to detail is required in preoperative planning and follow-up in the long run for optimum outcomes for the patients.

Keywords: Intracranial epidermoid cyst, Retrosigmoid approach, Surgical outcomes, Postoperative complications, Magnetic resonance imaging diagnosis

INTRODUCTION

Epidermoid cysts are benign, slow-growing lesions resulting from ectodermal cell remnants during embryogenesis. A thin stratified squamous epithelial lining and a keratin-filled lumen

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histologically define these inclusion cysts. Although uncommon, they constitute 0.5–2% of intracranial tumors and are most prevalent in adults aged 30–50 years.^[4] Epidermoid cysts typically arise in the central nervous system, most often in regions such as the cerebellopontine angle, posterior fossa, or suprasellar areas. Occasionally, they may be found in the spinal canal or within the diploic spaces of the skull. Unlike dermoid cysts, which tend to form along midline structures, epidermoid cysts exhibit a lateralized growth pattern. These cysts may appear at any time in life and are slightly more common in women. Symptoms include headaches, seizures, and neurological impairments, usually produced by pressure exerted by the cyst against surrounding tissue.^[6]

Although rare, epidermoid cysts are clinically significant due to their potential for recurrence and complications such as chemical meningitis in case of rupture. Imaging has become better with the advancement of techniques, and computed tomography usually shows hypo-attenuated, non-enhancing lesions, while magnetic resonance imaging (MRI) demonstrates characteristic signal patterns.^[2,4,8]

The treatment remains primarily surgical resection, aiming for gross total resection. This is usually difficult because the cyst capsule may be adherent to vital neurovascular structures. Microsurgical techniques, at times with endoscopic assistance, minimize problems and risks of recurrence. Despite such care, complications such as chemical meningitis from leaked cyst contents stress the need for prudent surgical management.^[3]

When complete excision is not possible, subtotal resections can be carried out, and the patients need long-term follow-up for recurrence. Most patients make a recovery without significant neurological deficits; however, complications related to surgery and the rarity of these lesions make them a challenging entity in neurosurgical practice.^[7]

The following study will research the demographic, clinical, and surgical features of patients with intracranial epidermoid cysts. It will also analyze factors affecting postoperative outcomes, including complications, and their relations to certain surgical approaches to improve further diagnostic accuracy, surgical management, and long-term care strategies.

MATERIALS AND METHODS

Study design and participants

This is a cross-sectional study of patients with operative management for epidermoid cyst-diagnosed cases admitted during the period from January 1st, 2020, to September 16th, 2024, to “Dr. Said Al-Witry’s Neuroscience Hospital.” Data collection will thus be regarding demographic, clinical,

radiologically, and surgical factors within this pre-defined period. The inclusion states histologically confirmed epidermoid cyst patients received surgical intervention. Excluding criteria included incomplete medical records besides other alternative diagnoses.

Data collection

Demographic data, including gender and age, were collected. Clinical factors assessed included the presence or absence of symptoms such as headache, facial weakness, decreased hearing, decreased vision, trigeminal neuralgia, and seizures. Imaging characteristics, specifically T1 and T2 signal intensities, were recorded. Details of surgical approaches- frontotemporal, midline sub-occipital, and rectosigmoid postoperative complications were extracted from medical records. Complications evaluated included cerebrospinal fluid (CSF) leaks, aseptic meningitis, facial nerve palsy, and hydrocephalus.

Statistical analysis

Frequencies and proportions were calculated to describe the demographic and clinical factors. Surgical approaches and postoperative complications were analyzed using descriptive statistics. Chi-square determined associations between postoperative active and various factors, including demographic, clinical, and surgical variables. Statistical significance was set at $P < 0.05$.

Ethical considerations

The study was concerned with the principles of the Declaration of Helsinki. Patient confidentiality was maintained throughout the study. As this was a retrospective analysis, informed consent was waived.

RESULTS

Frequencies of Demographic and Clinical Factors: Most major participants were male (75%, $n = 30$), while females accounted for 25% ($n = 10$). Headaches were 20 participants, with the remaining 50% ($n = 20$) reporting no headaches. Facial weakness was present in 12.5% ($n = 5$), decreased hearing in 5% ($n = 2$), reduced vision, trigeminal neuralgia in 5% ($n = 2$), and seizures in 17.5% ($n = 7$). Imaging findings showed T1 hypo-intensity in 95% ($n = 38$) and T2 hyper-intensity in 100% ($n = 40$) [Table 1].

Frequencies of surgical approach

Surgical approaches included retrosigmoid (60%, $n = 24$), frontotemporal (30%, $n = 12$), and midline sub-occipital (10%, postoperative complications were present in 35%

Table 1: Frequencies of multiple factors.

	Counts	% of Total	Cumulative %
Frequencies of Gender			
Gender			
Female	10	25.0	25.0
Male	30	75.0	100.0
Frequencies of Headache			
Headache			
Yes	20	50.0	50.0
No	20	50.0	100.0
Frequencies of facial weakness			
Facial weakness			
No	35	87.5	87.5
Yes	5	12.5	100.0
Frequencies of decreased hearing			
Decreased hearing			
No	38	95.0	95.0
Yes	2	5.0	100.0
Frequencies of decreased vision			
Decreased vision			
No	34	85.0	85.0
Yes	6	15.0	100.0
Frequencies of trigeminal neuralgia			
Trigeminal neuralgia			
No	38	95.0	95.0
Yes	2	5.0	100.0
Frequencies of seizure			
Seizure			
No	33	82.5	82.5
Yes	7	17.5	100.0
Frequencies of T1 (Hypo-intense or Hyper-intense)			
T1 (Hypo-intense or Hyper-intense)			
Hyper-intense	2	5.0%	5.0
Hypo-intense	38	95.0	100.0
Frequencies of T2 (Hypo-intense or Hyper-intense)			
T2 (Hypo-intense or Hyper-intense)			
Hyper-intense	40	100.0%	100.0
Frequencies of Surgical approach			
Surgical approach			
Frontotemporal	12	30.0	30.0
Midline sub-occipital	4	10.0	40.0
Retrosigmoid	24	60.0	100.0
Frequencies of presence of postoperative complications			
Presence of postoperative complications			
Yes	14	35.0	35.0
No	26	65.0	100.0

(Contd...)

Table 1: (Continued).

	Counts	% of Total	Cumulative %
Frequencies of Postoperative complications			
Postoperative complications			
CSF leak	2	5.0	5.0
Aseptic meningitis	4	10.0	15.0
No	26	65.0	80.0
Facial nerve palsy	6	15.0	95.0
Hydrocephalus	2	5.0	100.0
CSF: Cerebrospinal fluid			

($n = 14$) and absent in 65% ($n = 26$). Specific complications included CSF leaks (5%, $n = 2$), aseptic meningitis (10%, $n = 4$), facial nerve palsy (15%, $n = 6$), and hydrocephalus (5%, $n = 2$) [Figures 1 and 2].

Associations between complications and surgical approach

Chi-square analysis showed significant associations between complications and surgical approach (hearing ($P = 0.048$)). Gender was marginally associated with complications ($P = 0.056$). Other factors, such as headache ($P = 0.507$), facial weakness ($P = 0.507$), decreased vision ($P = 0.926$), trigeminal neuralgia ($P = 0.287$), and seizures ($P = 0.926$), were not significantly associated with complications [Table 2].

DISCUSSION

Demographic and clinical factors

Our findings showed a male predominance (75%), which aligns with prior studies suggesting a slightly higher prevalence of intracranial epidermoid cysts in males.^[6] This raises questions about potential biological or environmental factors contributing to gender disparity. Headaches, as a frequent symptom in half of our cohort, have been similarly documented as common clinical presentations in patients with epidermoid cysts.^[2] This highlights the importance of considering epidermoid cysts in the differential diagnosis of chronic or unexplained headaches, particularly when imaging reveals characteristic signal patterns. Less common symptoms, such as trigeminal neuralgia and seizures, reflect the findings of previous case studies on cerebellopontine angle epidermoid cysts.^[3]

Imaging findings in our cohort, including T1 hypo-intensity (95%) and T2 hyper-intensity (100%), are consistent with the classic MRI characteristics of epidermoid cysts highlighted in earlier reports.^[7] This consistency across patients highlights the importance of MRI as a diagnostic tool and calls for its routine use in cases with atypical symptoms and suspected central nervous system lesions.

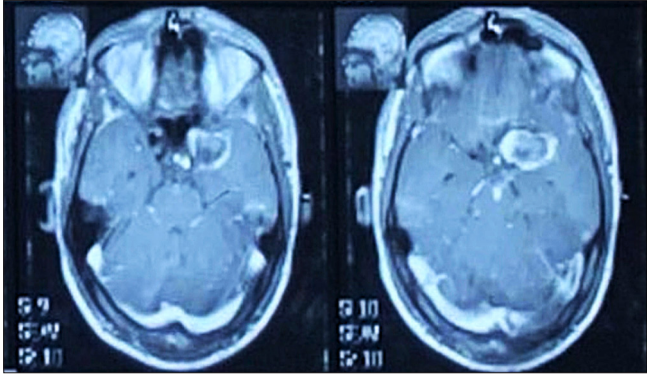


Figure 1: Preoperative magnetic resonance imaging (MRI) of a 19-year-old female patient presented with progressive facial weakness and numbness persisting for several months, consistent with cranial nerve involvement secondary to mass effect from a lesion in the fronto-cavernous region. Axial T1-weighted and post-contrast MRI images demonstrate a hypointense, non-enhancing lesion in the fronto-cavernous region, characteristic of an epidermoid cyst.

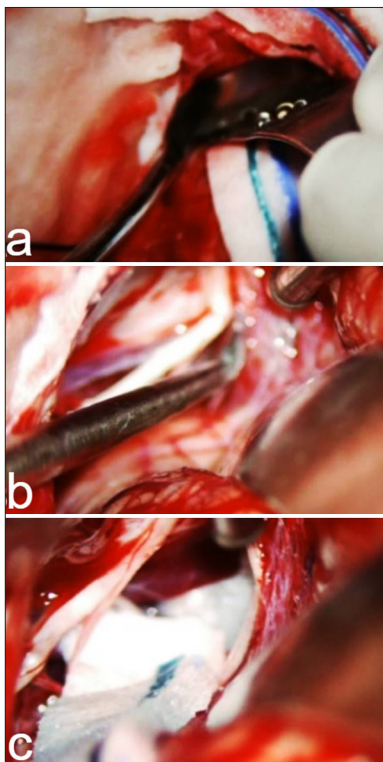


Figure 2: Intraoperative steps of surgical management of an intracranial epidermoid cyst. (a) The cerebellopontine angle is accessed through a retrosigmoid craniotomy. (b) Separating the anterior inferior cerebellar artery from the epidermoid cyst. (c) Gross total resection of the epidermoid cyst with meticulous preservation of surrounding tissues.

Table 2: Association between the presence of postoperative complications and multiple factors, including (gender, clinical picture, and surgical approach).

Factors	Presence of postoperative complications			P-value*
	Yes	No	Total	
Gender				
Female	6	4	10	0.056
Male	8	22	30	
Total	14	26	40	
Headache				
Yes	6	14	20	0.507
No	8	12	20	
Total	14	26	40	
Facial weakness				
No	12	24	36	0.507
Yes	2	2	4	
Total	14	26	40	
Decreased hearing				
No	12	26	38	0.048
Yes	2	0	2	
Total	14	26	40	
Decreased vision				
No	12	22	34	0.926
Yes	2	4	6	
Total	14	26	40	
Trigeminal neuralgia				
No	14	24	38	0.287
Yes	0	2	2	
Total	14	26	40	
Seizure				
No	12	22	34	0.926
Yes	2	4	6	
Total	14	26	40	
Surgical approach				
Frontotemporal	6	6	12	0.002
Midline sub-occipital	4	0	4	
Retrosigmoid	4	20	24	
Total	14	26	40	

*Chi-square

Surgical approaches and complications

Retrosigmoid craniotomy, the most commonly employed surgical approach (60%), was associated with fewer complications compared to frontotemporal and midline sub-occipital approaches. This observation corroborates findings from prior studies emphasizing the retrosigmoid approach as safer and more effective for cerebellopontine angle lesions.^[2]

Complications such as CSF leaks (5%), aseptic meningitis (10%), and facial nerve palsy (15%) align with documented risks of surgical management in these anatomically complex areas.^[1,7] These results emphasize the need for cautious surgical planning, possibly including minimally invasive or endoscopic approaches when necessary, to reduce trauma.

Associations of factors with complications

This is in agreement with the previous studies that suggested a significant correlation between the surgical approach with postoperative complications, indicating the need for appropriately chosen strategies concerning tumor location and involvement of neurovascular structures.^[5] The marginal association of the male gender with complications is less convincing and may require further investigation. Headaches, consistent with other reports, were not significantly related to postoperative outcomes.^[9]

Interestingly, there is no significant association between headache or seizure and post-seizures and postoperative presentations. Social presentations are thus not direct predictors of surgical success or complication risks. Hence, surgical decisions should be more based on imaging findings and the cyst's anatomical relations rather than symptomatology alone.

CONCLUSION

This study underlines the intracranial epidermoid cysts for their complexity in nature, pointing out the fact that they are very rare, diagnosis is quite problematic, and surgery has its nuances. The cysts are commonly presented as male sex predominance, headache, and seizures. Imaging studies are very important in diagnosing the condition due to typical T1 hypo-intensity and T2 hyper-intensity patterns. The retrosigmoid approach appeared to be the most effective surgical method since complications associated with it were fewer compared to the frontotemporal and midline suboccipital approaches. However, some complications, such as CSF leaks, aseptic meningitis, and facial nerve palsy, continued to occur. This shows that there is a significant association of complication incidence with the type of surgery; hence, exact pre-surgical planning according to cyst location and neurovascular involvement becomes necessary. The overall results of this work underlined how important imaging personalization for advanced surgical treatment and extended postoperative follow-ups are, including the management of outcomes optimization and the recurrence risks.

Ethical approval: The Institutional Review Board has waived the ethical approval for this study as it is retrospective study. The research/study complied with the Helsinki Declaration of 1964.

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