Original Article

PETROUS APEX CEPHALOCELE: A RETROSPECTIVE STUDY IN A TERTIARY CARE HOSPITAL.

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ABSTRACT:

Background
Petrous apex cephalocele represents a protrusion of meninges and CSF from the postero-lateral portion of Meckel's cave into the petrous apex that are usually incidentally detected but may be symptomatic. We reviewed MR and CT of 5 patients with PACS to identify characteristic imaging features that facilitate their diagnosis.
Methodology: We reviewed our archive from January 2015 to January 2018. Five patients were diagnosed with PACS. All patients underwent CT and MR examination of the cranium. We evaluated the lesions for extension into the neighbouring structures, content, signal intensity, enhancement pattern and relation to the Meckel's cave, petrous apex and for the presence of any additional features.
Result: The Most common presenting symptom was headache followed by tinnitus, vertigo, Facial pain and Sensory neural hearing loss. All lesions were centred postero-lateral to the Meckel's cave. Two patients had PACS bilaterally, 3 were unilateral and one patient was symptomatic and could be potentially related to PACS, symptomatic patient underwent surgery and rest were managed conservatively. **Conclusion:** PACS are uncommon lesions that are usually incidental but maybe symptomatic .PAC has characteristic imaging appearance with definitive preoperative diagnosis. Surgical intervention should be approached cautiously and undertaken only when symptoms are related to the lesion.
Keywords: Petrous Bone; Encephalocele; Computed Tomography; Magnetic Resonance Imaging.

INTRODUCTION

The petrous apex is the portion of the temporal bone, lying anteromedial to the inner ear. It is located between the sphenoid bone and the occipital bone and terminates at the foramen lacerum[1-3.] This area cannot be directly examined, so lesions of the petrous apex represent a challenging diagnostic and therapeutic problem to radiologists or neuroradiologists, even though they are the most experienced in dealing with these types of lesions.

CT or MRI plays a primary role in the evaluation of lesions located in this area.The petrous apex can be involved with various cystic and solid lesions [2, 3]. Cystic lesions, such as cholesterol granuloma, mucocele, and congenital or acquired cholesteatoma, are much more common than solid lesions[4]. A petrous apex cephalocele (PAC) is a rare lesion that arises from Meckel's cave, secondarily erodes the petrous apex, and is characterized by residing in an eccentric location, having a cystic appearance, and is contiguous to the posterolateral aspect of Meckel's cave on imaging findings [4,5].

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In the present context, we describe characteristic radiological findings that mark a petrous apex lesion as PAC. We also establish an idea that PAC can be frequently asymptomatic incidentally observed on cross-sectional imaging obtained for other clinical indications.

MATERIAL AND METHODS

Five patients were diagnosed with petrous apex cephalocele from January 2015 to January 2018.Patients were subjected to HRCT of temporal bone and MRI .HRCT examinations were performed with 16 slice with thin sections (0.75-1.0 mm) and special bony algorithm for high details and MR examination were performed with 1.5 tesla .The images were evaluated for extension into the neighboringstructures, signalintensity, relation to Meckel's cave and petrous apex, lesion margins and coexisting empty sella.

RESULTS:

patients 1 [Figure 1 and 2]and 2 presented with vague headache, patients 4 and 5 presented headache with tinnitus and patient 3[Figure 3,4 and 5]presented with signs of trigeminal neuralgia (Clinical findings summarized in table I).Among five patients, three had unilateral lesion among them one was symptomatic on the side of the lesion, two had bilateral lesions. All the lesions were centered in the posterolateral portion of the Meckel's cave and were continuous with it. None of them were related to the inner or middle ear structures. Cerebello-pontine angle and internal acoustic canal were intact in all cases. All the lesions showed CSF signal intensity on all sequences .There was no diffusion restriction on DWI images. One patient had partial

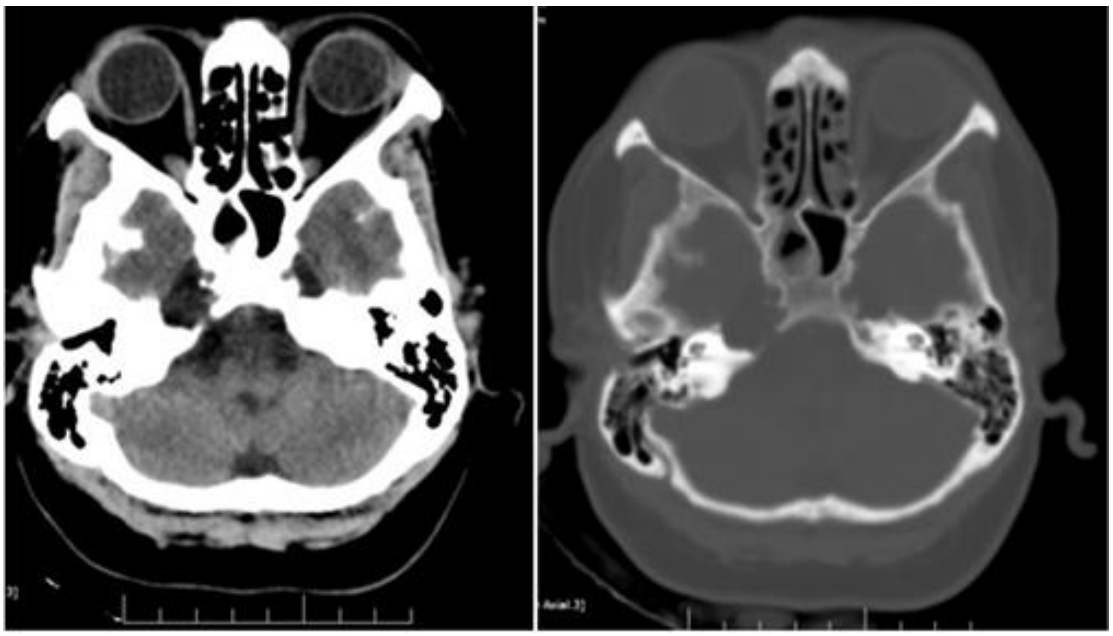


FIG: 1A CT (soft tissue) **FIG: 1B CT (Bone window)**

HRCT scan of temporal bone was performed which revealed sharply demarcated lesion with a thin cortical bone outline at the right petrous apex (*Blue arrow, FIG 1A and 1B).*

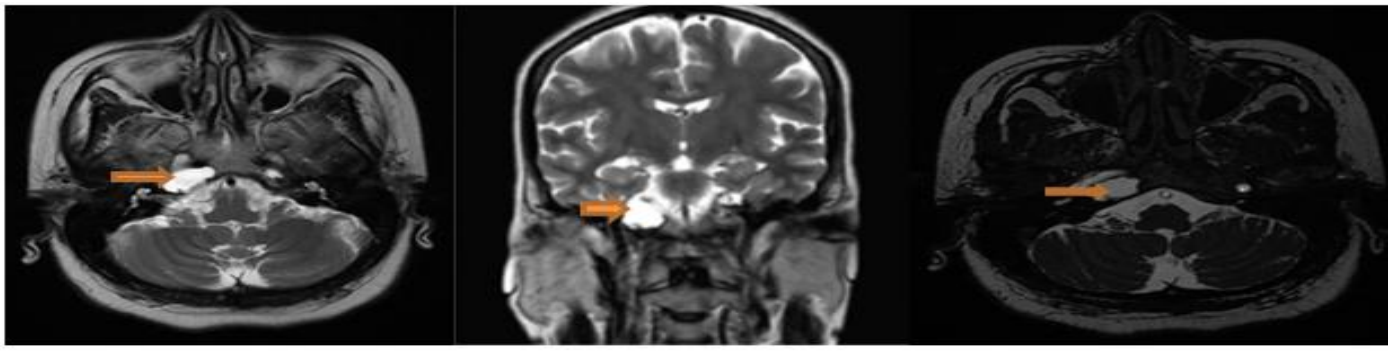
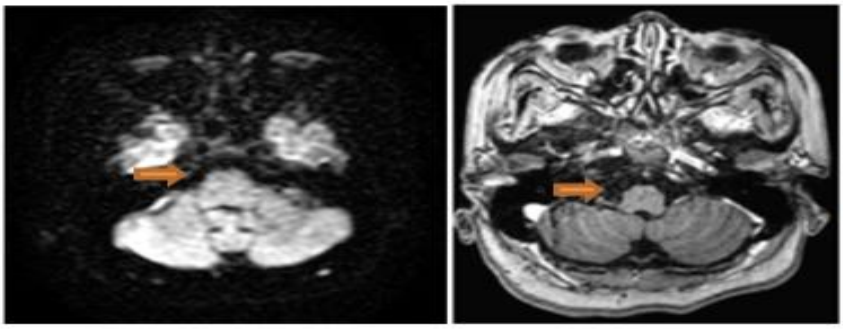


FIG: 2A (Axial T2) FIG: 2B (Coronal T2) FIG: 2C (Axial Fiesta)



- MRI of brain revealing lobulated cystic lesions, contiguous to Meckel's cave, at the right petrous apex. The lesion was showing characteristic CSF signal intensity(*Orange arrow,FIG:2A,2B,2C*)
- There was no diffusion restriction on diffusion-weighted image (DWI)*(Orange arrow FIG:2D)* or significant post contrast enhancement of the lesion*(Orange arrow FIG 2E)*

FIG: 2D (Axial DWI) FIG: 2E (Axial Bravo)

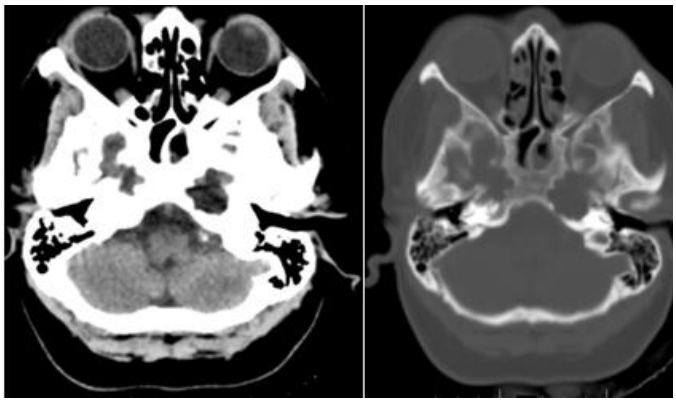


Fig 3A:CT (Axial soft tissue, Fig 3B (Axial Bone window). HRCT scan of temporal bone was performed which
revealed sharply demarcated lesion with a thin cortical bone outline at the left petrous apex

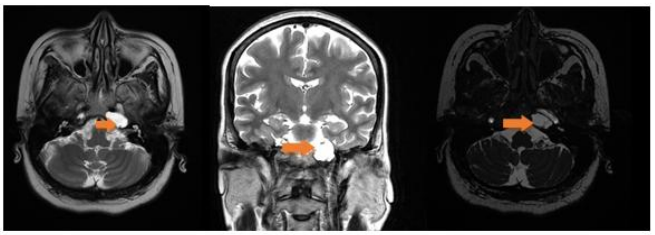
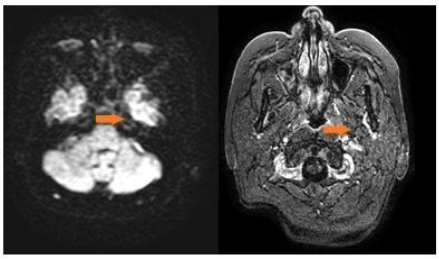


FIG:4A(Axial T2) FIG:4B(Coronal T2) FIG:4C(Axial Fiesta)



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- There was no diffusion restriction on diffusion-weighted image (DWI)(*Orange arrow ,FIG4D*)or significant post contrast enhancement of the lesion(*Orange arrow,FIG:4E*)

FIG:4D(Axial DWI) FIG:4E(Axial BRAVO)

Table:1 Showing summary of cases with clinical features and lesions characterizations

CASE NO	AGE	CLINICAL PRESENTATION	SIDE OF LESION	MANAGEMENT
I	46Y/F	headache with vertigo	RIGHT	NON OPERATIVE
II	43 Y/F	headache	RIGHT	NON OPERATIVE
III	37Y/F	left sided facial pain with episodes tingling	LEFT	SURGICAL INTERVENTION
IV	70Y/F	Headache.	BILATERAL	NON OPERATIVE
V	63Y/M	headache and vertigo	BILATERAL	NON OPERATIVE

Petrous apex lesions are uncommon and represent a spectrum of pathological and incidental findings. Petrous apex has a complex relationship with brain, cranial nerves and major vessels. So imaging plays an important role in evaluation of theses lesions in this area .Cystic lesions at petrous apex includes benign obstructive lesion of air cells (cholesterol granuloma),mucocele, congenital or acquired cholesterol mass and apical petrositis.Several characteristic imaging findings differentiate other inflammatory lesion from PACS(3, 4, 10) (Table II).

In our case series majority of the lesions were not related to the clinical signs and symptoms

We recognize two possible limitations to our study.

1.We describe a small, highly selected tertiary patient population and do not attempt to statistically evaluate the incidence or prevalence of non-inflammatory petrous apex cysts in the general population(1). Also, we do not have a sufficiently large group to statistically derive sensitivity and specificity for MR imaging and CT in this population(1). Nevertheless, although our sample size is too small to draw statistical inferences, our data show that the diagnosis of a cystic apex lesion does not necessarily imply that surgical intervention is required. Rather, correct diagnosis of a non-inflammatory apex cyst may prevent surgery that is based on the erroneous presumption of an inflammatory lesion.

2. Although MR imaging can usually identify herniated brain elements that distinguish a meningoencephalocele from a meningocele, it is difficult to ascertain the presence or absence of a dural lining on MR imaging studies to distinguish between a meningocele and an arachnoid cyst. This problem is the unfortunately frequent colloquial interchange of the terms meningocele and arachnoid cyst when describing these lesions, although it is probably not clinically important to distinguish between these two entities on imaging studies, because the operative approach in cases requiring surgery is unlikely to be significantly altered.

3. Previous research work did not have a diffusionweighted imaging sequence available at the time of data collection. We included DWI sequences in our study and it helped us to distinguish a PAC from an inflammatory lesion.(1)

Table-2: Characteristic image findings, differentiating other inflammatory lesions from PACS

CHARACTERISTIC	PACS	INFLAMMATORY LESIONS
Lesion centre	Outside of petrous apex (posterior portion of Meckel's cave.)	Inside petrous apex
Inflammatory changes	Absent	Present
CT attenuation	Low	Low
MR signal intensity(T1/T2)	Low/High	Low/High
Contrast Enhancement	Rim enhancement	Rim enhancement
Margins	Expansile	Expansile

DISCUSSION:

PACS has a characteristic imaging features of unilateral or bilateral fluid signal intensity or density, smooth noninvasive bony excavation of the petrous apex that originates from the Meckel's cave. PACS arise outside of Meckel's cave and secondarily erode into the petrous apex from the adjacent Meckel's cave, whereas

inflammatory lesions arise from and expand the petrous apex from within. The distinctive imaging appearance of PACS allows the imageologist to have a preoperative diagnosis with a high degree of certainty.Having described the lesion precisely patho-physiology still remains unclear.PACS can be inconsistently referred to as both meningocele and arachnoid cyst. The term PACS has been used because the lesion is either a congenital or acquired herniation of posterolateralMeckel's cave margin and contents into the petrous apex and depending upon what the surgeon discovers as the wall of this lesion is traversed, either the term meningocele or arachnoid cyst is most applicable.

PACS are most often identified as asymptomatic incidental finding on MR images. Definitive preoperative diagnosis of PACS from other inflammatory lesions of petrous apex avoids unnecessary surgical intervention .None of the other cystic lesions of petrous apex (cholesterol granuloma, mucoceles , apical petrositis and petrous apex effusion) arise from Meckel's cave as PACS does, which distinguishes it from other cystic lesions .Further PACS with characteristic imaging features has to be characterized based on their clinical symptoms as symptomatic or asymptomatic lesion requiring possible surgical intervention or conservative management.

Symptoms of symptomatic PACS can present with headache,hearing loss, otorrhea, seizures and hydrocephalus.All of the above symptoms are thought to be caused by imbalance in Intracranial pressure.

CONCLUSION:

PACs are less common than inflammatory cystic apex lesions that arise from sequelaeof air cell disease. PACs represent arachnoid cysts and meningoceles that arise from Meckel's cave that erode secondarily into the petrous temporal bone. They can be differentiated from inflammatory air cell sequelae that require surgical treatment by consideration of the osseous margins, lesion center , and relationship to nearby structures. Their behavior is less aggressive than that of inflammatory lesions. Unlike inflammatory apex cysts, non-inflammatory cysts do not require operative treatment, and a decision to operate should be carefully made on an individual basis. Longitudinal study of these patients, including attention to operative outcome if applicable, will clarify their clinical significance and natural history.

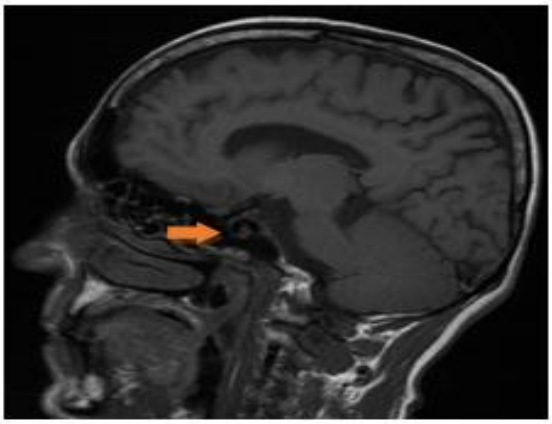

Fig-5: Partial empty sella indicating possibility of CSF imbalance (Orange arrow)

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