Unusual Appearances Of White Epidermoid Cyst On CT And MRI With Pathological Correlation – Two Case Reports
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Citation

Abstract
Epidermoid cysts in brain are commonly seen as hypo dense lesions on CT scan, hypo intense on T1W MR imaging with no post contrast enhancement and show marked restricted diffusion on DWI. Rarely they are hyper intense on T1W imaging and referred as white epidermoid. We describe two unique cases of rare white epidermoid cyst with unusual CT and MR features that showed no restriction of diffusion on DWI with a signal drop on ADC Map.

INTRODUCTION
Epidermoid cysts are commonly seen as hypo dense lesions in brain on CT (Computed tomography) scan, hypo intense on T1W MRI (Magnetic Resonance Imaging), show restricted diffusion and do not enhance on contrast study. But we hereby present two cases with unusual CT and MR features of rare white epidermoid cyst which may appear hyper dense or hypo dense on CT Scan and hyper intense on T1W MRI attributing to inherent content of the fluid which may be protein rich or keratin rich respectively. They showed lack of restriction of diffusion on DWI (Diffusion weighted imaging). The reason of this appearance was attributed to fluid nature of the lesions that was confirmed per-operatively.

CASE 1
A young 20 years old female presented with a short history of headache and vomiting and was referred for CT scan examination of brain. CT revealed a hyper dense lesion in pre pontine cistern encasing basilar artery [Figure 1].

Figure 1
Fig 1 - 20 years old female with right cerebello pontine angle epidermoid cyst

Non contrast axial CT scan shows a hyperdense extra-axial mass in the prepontine cistern and right cerebello-pontine angle

MRI examination was performed on 1.5-T superconducting whole-body MR system with a head coil with standard
sequences. T1W images showed extra axial homogeneous hyper intense lesion in preponite cistern extending to right cerebello-pontine cistern and into internal auditory canal. It encased basilar artery [Figure 2].

**Figure 2**
Fig 2 - T1W axial MR images show a well-defined high intensity mass encasing basilar artery extending to internal auditory canal on right side.

It appeared hypointense on T2W and FLAIR [Figure 3] sequences

**Figure 3**
Fig 3- T2W axial and FLAIR coronal MR images shows a well -defined lobulated hypo intense extraxial mass encasing basilar artery extending to internal auditory canal on right side.

The lesion showed no enhancement on post contrast T1W sequence [Figure 4].

**Figure 4**
Fig 4 - Post-contrast fat-suppressed T1-W spin-echo sequence shows no enhancement with persistent pre contrast hyper intense signal intensity

Gradient sequence revealed no flow voids to suggest hemorrhage or calcification and Diffusion weighted imaging showed no restricted diffusion and hence did not appear
bright as expected [Figure 5].

**Figure 5**

Fig 5- DWI axial scan ( b factor 0 -100 ) shows no restricted diffusion in the mass which appears dark.

Radiological diagnosis of white epidermoid cyst was considered.

At surgery a shiny cystic mass was removed with greenish colored fluid contents which immediately dissolved in the formalin solution. The mass being in close contiguity to basilar artery, near total resection was performed. Pathological analysis revealed a cystic lesion with few keratin cells and cholesterol crystals confirming our diagnosis [Figure 6]

**Figure 6**

Fig 6- Histopathological analysis shows cystic mass with few keratin cells and cholesterol crystals confirming epidermoid cyst.

**CASE 2**

A 45 years old female was referred to the department for evaluation of chronic headache with no other physical ailment. She was subjected to CT scan that revealed a well defined hypodense lesion in left frontal lobe with a peduncle extending to intra-diploic space of frontal bone [Figure 7].

**Figure 7**

Fig 7- NCCT shows a well defined hypodense pedunculated lesion in left frontal lobe with peduncle extending to intradiploic space of frontal bone
MRI was then performed with standard sequences and contrast administration. A well defined extra-axial lesion was seen in left frontal lobe that was hyper intense on T1W sequence [Figure 8].

**Figure 8**
Fig 8- T1W axial scan shows a well defined hyperintense mass in left frontal lobe with hypointense peduncle extending to intradiploic space

It showed no contrast enhancement. It was hyper intense on T2W and FLAIR sequences [Figure 9].

**Figure 9**
Fig 9- T2 W axial and FLAIR coronal scan shows a well-defined hyperintense lesion in left frontal lobe with a heterogeneous intensity peduncle extending to intradiploic space.

Heterogeneous hypo intense nodular signal was noted near the peduncle of the lesion on T1W and T2W sequences. No e/o restriction was seen on Diffusion weighted sequence [Fig 10].

**Figure 10**
Fig 10- DWI axial scan (b factor 0-100) shows no restricted diffusion in cyst which appears dark except at peduncle which appears bright.

A diagnosis of extra-axial white epidermoid cyst was
considered. Surgical resection of a cystic lesion was performed, and pathological analysis confirmed an epidermoid cyst lined by squamous epithelium with abundant keratin crystals, inflammatory infiltrate and foamy macrophages within the fluid content of the cyst.

**DISCUSSION**

Epidermoid cysts are benign congenital lesions of ectodermal origin. Nearly 1% of all intracranial tumors are epidermoid cyst. Although these lesions are congenital, patients are usually not symptomatic until they are aged 20-40 years.

Epidermoid cysts are most commonly located at the cerebellopontine angle cistern (40%–50%). Other sites of occurrence are fourth ventricle (17%) and the sellar and parasellar regions (10%–15%). Cerebral hemispheres and brainstem are less common locations. Rarely, they are seen in extradural intradiploic space of skull or in spine (10%). These lesions are located off the midline [1, 2]. Mostly, they are asymptomatic but sometimes may cause mass effect, cranial neuropathy, or seizures [1]. In our first case it was located at right cerebellopontine angle while in second case it was in supratentorial left frontal region. Both the patients in our cases presented with headache. An important clue to diagnosis is that it insinuates in cisterns, encases nerves and vessels [2]. It usually has CSF like appearance. On CT scans, most epidermoid cysts are well-defined hypodense lesions that resemble CSF and do not enhance. Calcification is present in 10%–25% of cases. Most epidermoid cysts are isointense or slightly hyper intense to CSF on both T1- and T2-weighted MR images. They do not usually suppress on FLAIR images which differentiate them from arachanoid cysts. However, sometimes epidermoid may appear as a low-intensity lesion on FLAIR sequence. In such cases DWI may differentiate it from arachanoid cyst, on which an epidermoid remains bright while arachanoid cyst shows fluid suppression and appear dark [10]. Most of them do not enhance, although some minimal rim enhancement occurs in approximately 25% of cases.

In our first case the lesion was hyper dense on CT scan while in second case it was hypo dense owing to high keratin crystals in the cyst. Both the cases showed lesions to be hyper intense on T1W images as compared to CSF. This type of appearance is very rare to occur [3]. Pathologically, rare “white epidermoids” have high protein content and may appear hyper attenuated on CT scans. Compared with the classic epidermoid cyst, these “dense” or white epidermoids show reversed signal intensity on MR images, with high signal intensity on T1- and low signal intensity on T2-weighted images [2]. On T2-weighted images, the signal intensity reduces with increasing protein concentration [7]. According to one report the hypo dense epidermoids have a pearly appearance with white, waxy material rich in cholesterol crystals, while the hyperdense epidermoids are grossly cystic and contain fluid of various colors [3]. This was true in our case where on surgery; the dark colored proteinaceous fluid was found which immediately dissolved in the solution of specimen bulb in first described case where cyst was hyperdense on CT, hyperintense on T1W and hypointense on T2W sequence while the fluid was rich in cholesterol crystals in second case where cyst appeared hypodense on CT scan and hyperintense on both T1W and T2W sequences.

The physiochemical basis of CT hyper density of the tumor is unclear; hypothetically thought to be due to proteinaceous contents of the cyst [4, 5], prior bleeding into the cyst, abundance of polymorphonuclear leukocytes, saponification of the debris to calcium soaps, and deposition of ferrocalcium complex or iron-containing pigment.

As per study by Li F et al recurrent leakage of the irritating cyst contents and subsequent chemical inflammatory response may be responsible for the high-density on CT scans and the cystic nature. A correct histological diagnosis is important because, in contrast to typical epidermoid cysts and other lesions, hyper intense epidermoid cysts are more prone to spread intra-operatively and result in severe aseptic meningitis [6].

Diffusion weighted imaging (DWI) informs about molecular diffusion motion of water molecules (Brownian motion) in the examined tissues. ADC (Attenuated Diffusion Coefficient) of epidermoid tumors is similar to that of brain tissue whereas the ADC of cystic lesions is similar to that of CSF [9]. Reported ADC values of epidermoid cysts range from 986_10^{-6} \text{mm}^2/\text{s} to 1360_10^{-6} \text{mm}^2/\text{s} [6, 8].

In both our reported cases, epidermoid cyst is not typically hyper intense compared with CSF and brain tissue on DWI. Because DWI basically is a diffusing proton-attenuated T2-weighted sequence with a given b value, contrast not only depends on the ADC but also on the T2 values and proton density. Thus here the appearance in first case can be attributed to lack of T2 shine through effect due to inherent proteinaceous nature of the fluid while in second case it can
be attributed to marked fluid nature of the lesion allowing free Brownian motion of the protons.

References

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