Typical and Atypical Space Occupying Lesions of the Cerebellopontine Angle: A Pictorial Review

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Learning objectives

To be aware of the appearances of some common and uncommon cerebellopontine angle lesions based on their anatomical origin and MR imaging characteristics.

To apply a table and algorithm to help try and simplify diagnosis of these lesions.

Background

MR imaging of space occupying lesions of the cerebellopontine angle constitute an important part of head and neck radiology. Classification of cerebellopontine angle lesions is challenging and there is no easy way of differentiating the myriad of possible diagnoses. However classification of these lesions based on their anatomy of origin as well as the application of key discriminatory MR sequences help narrow the differential diagnosis considerably.

One needs however to bear in mind that vast majority of these lesions are acoustic neuromas. Thus one can statistically assume that a lesion in the cerebellopontine angle is an acoustic neuroma until proven otherwise. However distinguishing an acoustic neuroma from other lesions is important in determining further management.

Imaging findings OR Procedure details

ACOUSTIC NEUROMAS

The most common lesion in the cerebellopontine angle is an acoustic neuroma[1]. It most commonly presents as an ovoid mass centred along the axis of the internal acoustic meatus ('ice cream cone' sign)[2]. In the majority of cases, lesions are isointense or slightly hyperintense to the pons on T1, hypointense to csf on gradient echo CISS sequences and hyperintense on T2[2]. There is strong enhancement in the majority of lesions post contrast. There can be foci of high signal T1 signal due to haemorrhage but this is rare. Furthermore cystic acoustic neuromas are recognised in the literature[3].

Figure 1, 2 and 3 show MR appearances of an acoustic neuroma.

MENINGIOMAS
These originate from the meninges and have a distinctive shape, with a broad base at their origin. On MR imaging, they are isointense or slightly hypointense on T1. There may be areas of hypointensity if the tumour is fibrous or calcified [4]. T2 appearances are variable, but isointense or hyperintense compared to grey matter is commonest. Flow voids may be seen within the tumour relating the arterial feeders. Enhance strongly on post contrast images, which also helps delineate an enhancing dural tail [5].

Figure 4 and 5 and 6 show MR appearances of a meningioma.

**ARACHNOID CYSTS**

Arachnoid cysts are CSF filled intrarachnoid masses. As a result MR features match CSF almost exactly. They are often pouch like in shape, conferring smooth round edges resulting in the displacement of neurovascular structures and often erosion of adjacent bony structures. There is no enhancement after contrast [6].

Figure 7, 8 and 9 show MR appearances of an arachnoid cyst.

**EPIDERMOID CYSTS**

On MR imaging, epidermoid cysts are the same or slightly higher signal intensity than CSF on T1 and T2-weighted images [7]. They are often homogenous signal. They may show increased signal on FLAIR and demonstrate restricted diffusion on diffusion weighted imaging. They do not enhance with contrast [8,9].

Figure 10, 11 and 12 show MR appearances of an epidermoid cyst.

**LIPOMAS**

Lipomas are fatty lesions and are thus homogeneously high signal intensity on T1-weighted images, decreasing with fat-suppression. There is no contrast enhancement. As a result unenhanced T1-weighted imaging help identify spontaneous hyperintense lesions, such as lipomas [10].

Figure 15 shows the T1 weighted MR appearance of a lipoma.

**GLOMUS JUGULARE**

This is a benign tumour arising from the jugular foramen. The characteristic T1 'salt and pepper' appearance can be in larger lesions (more than 2cm) [11]. On T2 sequences,
the tumour appears as high signal with areas of low signals. It demonstrates avid enhancement with contrast[11].

Figure 13 show MR appearances of a glomus jugulare tumour.

**ENDOLYMPHATIC SAC TUMOUR**

Endolymphatic sac tumours are papillary adenomatous tumours originating from the endolymphatic sac. At MR imaging, they appear heterogeneous on both T1- and T2-weighted images. The presence of blood or protein filled cysts appear hyperintense on T1- and T2-weighted images. Heterogeneous enhancement is seen after contrast administration [1].

**LYMPHOMA**

Lymphomas have variable appearances on MR imaging. They are commonly hypointense on T1-weighted images and hyperintense on T2-weighted images and enhance after contrast agent injection. As they are intraaxial they may exhibit mass effect and oedema. These features may help distinguish it from more common tumours such as acoustic neuromas[12]

Figure 14 shows the MR appearances of a lymphoma post contrast. Note how it can be difficult to distinguish from an acoustic neuroma.

**ANEURYSMS**

Aneurysms may arise from branches of the vertebral and basilar arteries and commonly are void of signal on conventional spin echo sequences. They can characteristically be very low signal on T2. The presence of a thrombus may cause them to be high signal on T1 and exhibit contrast enhancement. [1].

**Images for this section:**
**Fig. 1:** Gradient Echo CISS sequence. Axial MR in a patient demonstrating an acoustic neuroma in the right cerebellopontine angle.
**Fig. 2:** Coronal T1 image of a patient with an acoustic neuroma in the right cerebellopontine angle.
Fig. 3: Axial T1 post gadolinium in another patient with a right sided acoustic neuroma.
**Fig. 4:** Axial Gradient Echo CISS sequence demonstrating a meningioma in the left cerebellopontine angle.

**Fig. 5:** Axial T2 image showing a meningioma in the left cerebellopontine angle.
Fig. 6: Axial T1 post gadolinium in the same patient post contrast, demonstrating avid enhancement.
Fig. 7: Axial T2 image of an arachnoid cyst in the right cerebellopontine angle.
Fig. 8: Axial T1 image in the same patient with an arachnoid cyst right cerebellopontine angle.
**Fig. 9:** Diffusion weighted imaging of a patient with a right CPA arachnoid cyst showing no restricted diffusion.
Fig. 10: Axial T1 image of an epidermoid cyst in the left cerebellopontine angle.
Fig. 11: Axial T2 image of the same patient with an epidermoid cyst in the left cerebellopontine angle.
Fig. 12: Diffusion Weighted Imaging in the same patient confirming restricted diffusion within the epidermoid cyst
**Fig. 13:** Axial T1 post contrast demonstrating a glomus jugulare tumour invading the right cerebellopontine angle.

![Axial T1 post contrast demonstrating a glomus jugulare tumour invading the right cerebellopontine angle.](image)

**Fig. 14:** Axial T1 post contrast demonstrating a lymphoma in the right cerebellopontine angle.
Fig. 15: Axial T1 image demonstrating a lipoma in the right cerebellopontine angle.
Conclusion

The combination of standard T1 and post contrast sequences have an important role in approaching the diagnosis of cerebellopontine angle space occupying lesions. The standard T2 sequence alone is less discriminatory. Diffusion Weighted Imaging (DWI) has a crucial part in differentiating an epidermoid cyst from arachnoid cyst.

Distinguishing a neuroma from meningioma is difficult and cannot be made solely on signal characteristics. The combination of signal characteristics together with the an understanding of the anatomy and morphology of the lesion can yield a high diagnostic confidence.

The algorithm provided should help discriminate cerebellopontine angle lesions.

The table in figure 1 summarises the imaging findings of the cerebellopontine angle lesions described.

Figure 2 represents the algorithm for CPA angle lesion diagnosis. T1 weighted imaging has been used as the initial discriminatory sequence in the algorithm. Note that lymphoma may be intra or extra-axial. Glomus tumours are rare, but can be of variable signal on T1, thus appearing on both sides of the algorithm. The asterix refers to looking at the table above which states additional features that help differentiate an acoustic neuroma from a meningioma.

One needs to bear in mind that the algorithm merely provides a framework to help narrow the differential diagnoses. Thus not all recognised uncommon CPA angle tumours have been mentioned in this algorithm.

Images for this section:
<table>
<thead>
<tr>
<th>Tumours</th>
<th>T1</th>
<th>T2</th>
<th>Post Contrast</th>
<th>Others</th>
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<td>Neuromas</td>
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<td>↑</td>
<td>↑</td>
<td>Commonly arises from the IAM in 80%. Cystic changes common</td>
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<td>Dural tail is rare</td>
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<tr>
<td>Meningioma</td>
<td>↔️</td>
<td>↔️↑</td>
<td>↑️↑</td>
<td>Dural tail (up to 70%)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minimal peritumoral oedema</td>
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<td>Arachnoid Cyst</td>
<td>↓️</td>
<td>↑️</td>
<td>Non</td>
<td>FLAIR CSF signal inversion.</td>
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<td>Non</td>
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<tr>
<td>Lipoma</td>
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<td>↔️↓️</td>
<td>Non</td>
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<td>↔️</td>
<td>↑️↑</td>
<td>Speckled appearance</td>
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<td>Sac Tumour</td>
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<td>Cystic components</td>
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<td>Hydrocephalus</td>
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<tr>
<td>Glomus Jugulare</td>
<td>↑️</td>
<td>↑️</td>
<td>↑️↑</td>
<td>Classic Salt and Pepper appearance</td>
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<td></td>
<td></td>
<td>At the dome of jugular bulb</td>
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<tr>
<td>Lymphoma</td>
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<td>↑️</td>
<td>↑️</td>
<td>Intra-axial</td>
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<tr>
<td>Aneurysm</td>
<td></td>
<td></td>
<td>↑️↑</td>
<td>Flow void. Arising from distal AICA, SCA, basilar or vertebral arteries.</td>
</tr>
</tbody>
</table>

Fig. 1
Fig. 2
Personal Information

Dr Indrajeet Das is a 3rd year resident in radiology in the West Midlands Training Scheme. He has an interest in both Neuro and Head and Neck radiology.

References

References


