Radiological review of the most common tumors appearing in the cerebello-pontine angle. Diagnostic keys

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Learning objectives

We intend, through this work, a review of the most common tumors that appear in the cerebellopontine angle, also listing those appearing less frequently. The goal is not to make an exhaustive study of the same, but to explain fundamental radiological characteristics, both MDCT and MR, as well as to describe the main differential diagnoses schematically and easily. All this in order to facilitate the work of the radiologist, so that will lead to speed and reliability.

Background

INTRODUCTION:

Tumors of the cerebellopontine angle (CPA) constitute about 6-10% of all intracranial tumor, it is a disease common in adults and rarely in children. There is a wide variety of conditions that can occur at this level, derived from both the structures forming the cerebellopontine angle, as lesions that grow near it and can secondarily invade. Most are masses of extra-axial location with imaging characteristics that allow differential diagnosis with intra-axial lesions.

Table 1: Differential characteristics of intra or extra-axial cerebellopontine angle lesions:

<table>
<thead>
<tr>
<th>INTRA-AXIALES</th>
<th>EXTRA-AXIALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease or narrowing of the ipsilateral CPA cistern</td>
<td>Widening ipsilateral cistern APC</td>
</tr>
<tr>
<td>They can cause edema in adjacent parenchyma</td>
<td>Extrinsic mass effect on the cerebellum or brain stem adjacent</td>
</tr>
<tr>
<td>No CSF slit present between the mass and the adjacent parenchyma</td>
<td>CSF cleft between the mass and adjacent brain</td>
</tr>
<tr>
<td></td>
<td>Can move or include neurovascular structures.</td>
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The masses are the most common vestibular-cochlear schwannoma and meningioma, representing approximately 85 to 90% of all tumors of the APC. Next in frequency epidermoid cyst and schwannomas of other cranial nerves.
CEREBELLOPONTINE ANGLE ANATOMY:

The cerebellopontine angle is a space filled with CSF, located in the lateral margin of the posterior fossa in situation prior to the lateral cerebellar hemispheres and pons.

Presents a triangular morphology, so that the roof is limited by the tentorium. The longest side of the triangle is the side edge formed by the rear region of the petrous temporal bone. The medial side is formed by the lateral edge of the anterior and the posterior bulge and cerebellar hemisphere.

The side outlets of the 4th ventricle, the foramen of Luschka, mark the boundary between the APC and the cerebellum-medullary cistern. The APC cistern tank is continued through the hiatus perimesencephalic tentorial.

Of cranial nerves V to VIII are located on top of the tank containing the lowermost portion thereof the IX, X and XI.

The cistern extending into the IAC (internal auditory canal), surrounding the VII (facial) and VIII (vestibular-cochlear) cranial nerve, which arise on the lateral side of the pons. The facial nerve is slightly anterior and superior vestibular-cochlear nerve.

The V cranial nerve crosses the superior aspect of the tank from the side bump into Meckel's cave.

It contains, in addition to the cranial nerves, major vascular structures: the anterior superior cerebellar arteries and veins tributary vessels superior petrous.

Masses that can be located in the cerebellopontine angle:

The cerebellopontine angle is surrounded by meninges of cerebellum-pontine cistern containing LCR addition, neurovascular structures. Each containing structures may give rise to injury, may also find this level from brain injury, the temporal or skull bone of adjacent residues and may be embryonic inside.

It is important to know the normal structures and anatomic variants that may be confused with a mass of APC and may lead to wrong diagnosis: cerebellar flocculus, choroid plexus prominent Luschka hole, high jugular bulb or tuber prominent jugular.

Table 2: Masses of cerebellopontine angle and frequency:

<table>
<thead>
<tr>
<th>MASSES OF CEREBELLOPONTINE ANGLE AND FREQUENCY</th>
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</table>
Acoustic or vestibular schwannoma 80-90%
Meningioma 10-15%
Epidermoid cyst 5-9%
Other schwannomas 2-5%
Vascular ectasia vertebr-basilar aneurysm, vascular malformation 3-4%
Metastasis 1-2%
Paraganglioma 1-2%
Ependymoma, choroid plexus papilloma <1%
Arachnoid cyst <1%
Lipoma <1%
Dermoid cyst <1%
Exophytic cerebellar or brain stem astrocytoma <1%
Chordoma, osteo-cartilaginous tumors, Very rare neurenerteric cyst, neuroepithelial cyst, cholesterol granuloma, endolymphatic sac tumor, lymphoma, hemangioblastoma, medulloblastoma

**Imaging findings OR Procedure details**

**VESTIBULAR SCHWANNOMA**

Vestibular schwannomas (acoustic neuromas, neuromas or neurilemomas) constitute 95% of intracranial schwannomas and 85% of APC tumors in adults.

Cervical polyps are benign, encapsulated, slow-growing and originate from myelin-producing cells, called Schwann cells. They can appear in cranial and peripheral nerves, most commonly in sensory nerves.

The eighth cranial nerve (vestibular-cochlear) is the most common, affecting the lower division of the same in 91.4% and the top division in 6%.

Most of them are sporadic tumors, 5-20% of patients with solitary schwannomas have neurofibromatosis type II.
The sporadic schwannomas usually appear between the ages of 30 and 40. In patients with neurofibromatosis type II, may occur during the second decade of life and only exceptionally in over 55 years.

Several studies claim that there is no sex predilection, while others argue that it is more common in women.

 Clinically usually present with progressive hearing loss or tinnitus, less common symptoms are dizziness, balance problems and facial paralysis. Rarely acute haemorrhagic expansion or degeneration of a schwannoma can cause a patient presenting with acute onset of dizziness or vomiting.

Histologically is an encapsulated neoplasm composed of spindle Schwann cells with high cellularity areas alternating with lower density in a reticulated myxoid matrix. Degenerative changes are common: cystic, and fatty degeneration vascular prominences.

**Imaging findings:**

In 70 to 90% of cases, signs of erosion enlargement of the internal auditory canal. Erosion and pore same acoustic schwannoma indicated in 93% of cases.

Most vestibular schwannomas grow within the CAI and secondarily expand into the tank of the APC and may be entirely intracanalicolar or have other cisternal and intracanalicular component, which gives the typical cone morphology (Figura 1).

The largest portion of the tumor is spherical and is usually in the APC (Figura 2). Rarely are purely intracisternal.

Small tumors are solid and homogeneous, the larger ones may have degenerative changes are essentially heterogeneous.

The radiologic findings on TC are spherical mass or cone shaped form acute angle with the petrous bone, iso or hypodense compared to brain parenchyma. After contrast administration small tumors have homogeneous enhancement, the larger ones have heterogeneous characteristics, with cystic and hemorrhagic changes.

In MRI are isointense or slightly hypointense mass relative to parenchyma on T1-weighted sequences, whereas usually hyperintense on T2-weighted sequences. Following administration of Gadolinium capture more intensively appear homogeneous and without contrast, more heterogeneous capturing the larger size (Figura 3).

With MR imaging techniques have advanced values of apparent diffusion coefficient higher than meningiomas. In perfusion volume ratio of regional cerebral blood half meningiomas usually greater than schwannomas.
In Schwannoma typically spectroscopy shows the increase of myoinositol.

**Differential diagnosis:**

-Meningiomas: schwannomas are usually hyperintense on T2 while meningiomas are usually iso-or hypointense. The rounded shape and location centered vestibular schwannoma CAI suggest more. (Table 3)

-Other schwannomas: we do based mainly on the nerve location affection neuroanatomical, enlarged relates foramen that said rib and the corresponding fat amyotrophy innervating muscles. VIII tumors are confined to the posterior fossa while the V cranial nerve is located at the boundary between the middle cranial fossa and posterior.

**Diagnostic keys:**

Typical mass cone morphology (intracanalicular component and component intracisternal), hypo-or isodense on CT. The tumors are small and spherical morphology normally present are within the CAI. In MRI hypointense or isointense on T1 and contrast vividly capture.

**MENINGIOMA**

They represent 10 to 15% of tumors located in the cerebellopontine angle, being the 2nd mass often at this level.

They are slow-growing masses originating from arachnoid meningoepteliales cells. At this location tend to grow from the dorsal aspect hard petrous bone.

They are more common in females: female-male ratio of 2:1 to 4:1, depending on the series.

Peak prevalence between 45 and 55, being more common in people over 40 years and in patients with neurofibromatosis type II, often in multiple locations.

Macroscopically are well circumscribed mass, homogeneous, firm, elastic, usually with a broad base of attachment to the dura. Can induce bone overgrowth closest (hyperostosis), even without histological infiltration thereof. Describes at least three histological subtypes: meningothelial or syncytial fibroblast or fibrous and transitional or mixed.

Clinical symptoms they cause are: hearing loss, tinnitus, and headache, the larger ones may present with cerebellar signs and V cranial neuropathy.
**Imaging findings:**

In TC morphology masses are usually oval or hemispheric, homogeneously hyperdense which capture intensely after contrast administration. In bone window can appreciate associated hyperostosis (Figura 4).

In MRI lesions are isointense relative to the cerebral cortex on both T1 and T2 contrast quickly capture and intense.

The main differential diagnosis we do with schwannomas.

Meningioma is characteristic of the CAI absence of enhancement, however, can capture the eighth nerve as described in meningiomas with growth plate extending along the nerve sheath.

Usually present the call sign of the dural tail consisting of a curvilinear area of contrast which may be due to tumor infiltration dural or vascular hyperplastic changes secondary to the mass adjacent reagents. Because noise may affect the pore CAI and extend into the dural tail detection is a key to differentiate diagnostic schwannomas meningiomas.

Calcifications can but rarely a meningioma of APC has extensive calcification.

**Diagnostic keys:** Mass with oval morphology, hyperdense on CT with and without contrast, and hyperostosis associated dural tail.

**Table 3: Differential diagnosis meningioma / schwannoma**

<table>
<thead>
<tr>
<th>Schwannoma</th>
<th>Meningioma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass spherical or cone-shaped</td>
<td>Hemispherical or oval Mass</td>
</tr>
<tr>
<td>Usually centered CAI</td>
<td>Rarely centered CAI</td>
</tr>
<tr>
<td>Spacious and erodes CAI</td>
<td>If not invades CAI, not eroded or enlarged it</td>
</tr>
<tr>
<td>Hyperintense on T2</td>
<td>Usually produce hyperostosis with bone window</td>
</tr>
<tr>
<td>Usually CAI contrast</td>
<td>Isointense or hypointense on T2</td>
</tr>
<tr>
<td>Cone sign</td>
<td>CAI no contrast</td>
</tr>
<tr>
<td>ADC values higher</td>
<td>Dural tail Singh</td>
</tr>
<tr>
<td></td>
<td>ADC values lower</td>
</tr>
</tbody>
</table>
Perfusion values greater

| Increase of myoinositol | Peak of choline, absence or low of N-acetyl aspartato and creatine, presence of alanina. |

**EPIDERMOID CYST**

Third APC tumor frequency, constitutes 5% of the mass located at this level and 0.2 - 1.8% of primary intracranial tumors.

Are located outside the middle line, cerebellopontine angle is the most common intracranial location (40-50%).

Congenital inclusion cysts are compounds of elements of the skin.

The peak incidence is 4-5th decade of life.

Most are asymptomatic, but can cause symptoms similar to schwannomas and meningiomas: tinnitus, hearing loss. More rarely can cause symptoms by mass effect, cranial neuropathy or seizures. In case of breakage causing chemical meningitis.

Histology: were formed early in embryogenesis by inclusion of ectodermal epithelial tissue during closure of the neural tube. Acquired epidermoid cysts are uncommon in the brain and can occur after trauma.

Masses are usually uniloculadas undulating contour, with a smooth but gnarled that shines like a pearl, so they are called pearly tumors. Having a coating of stratified squamous epithelium supported by an outermost line of collagenous connective tissue. They grow slowly over decades by continuous shedding of cells inside accumulate debris, keratin, water and cholesterol.

And conform around the surface shape of the protrusion, cerebellum and brain stem adjacent. They can become quite adherent to the surrounding structures, surrounding and including nerves and vessels, making it difficult to resection.

Calcifications can be patched on the surface.

The transformation into squamous cell carcinoma is extremely rare.

Patchy calcifications may present on the surface.

The transformation into squamous cell carcinoma is extremely rare.

**Imaging findings**
In TC are homogeneous mass, well defined, with irregular and lobed. Presented attenuation values similar to water and occasionally slightly negative as -10 or -20, but never as much as fat (-90 or less). Appear within encompassing tanks and vessels and nerves are not capturing contrast.

They are rare findings of calcifications marginal or erosion of the adjacent bone.

The central portion is avascular and misses can rarely be an peripheral uptake ring.

In Magnetic Resonance are isointense or slightly hyperintense mass relative to CSF on both T1-T2, with heterogeneous characteristics. Suppress completely on FLAIR and diffusion-restricted. Most do not enhance after intravenous contrast, although about 25% of cases there may be a minimum ring enhancement (Figura 5).

Epidermoid described or dense white high protein content that may appear in TC hipertatenuados. Compared with typical signal intensity have invested in RM with high T1 and low T2.

**Differential diagnosis:**

The differential diagnosis is more frequent and difficult to arachnoid cyst: these are usually isointense relative to CSF on all MR sequences, including FLAIR. Arachnoid cysts, as opposed to moving more epidermoid cysts surrounding neurovascular structures.

The apparent diffusion coefficient is significantly lower for squamous for the arachnoid cyst that, appreciating high signal intensity on diffusion for epidermoid.

**Diagnostic keys:** Injuries captantes no signal strength very similar to CSF on both CT and MRI. Restricted in distribution.

**Table 4: Differential Diagnosis epidermoid cyst / arachnoid cyst**

<table>
<thead>
<tr>
<th>EPIDERMOID CYST</th>
<th>ARACNOID CYST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal strength is very similar to LCR</td>
<td>Isointense with the LCR in all the</td>
</tr>
<tr>
<td></td>
<td>sequences, including FLAIR</td>
</tr>
<tr>
<td>Surrounding or include neurovascular</td>
<td>Moves neurovascular structures</td>
</tr>
<tr>
<td>structures</td>
<td></td>
</tr>
<tr>
<td>Restrict in diffusion, lower ADC values</td>
<td>Not restrict in diffusion, higher ADC values</td>
</tr>
<tr>
<td></td>
<td>Often erode adjacent bony structures.</td>
</tr>
</tbody>
</table>
OTHER SCHWANNOMAS:

They account for 2-5% of tumors of the cerebellopontine angle.

The imaging characteristics are the same for all possible components including cystic or hemorrhagic. They can develop in all cranial APC but mostly they do the V and VII.

The schwannoma of cranial nerve V may be very similar to vestibular but has a more anterior-posterior and extends into or within the Meckel's cave (when extended to the cavum can be difficult to differentiate a meningioma).

Differential diagnosis of facial nerve schwannomas with vestibular schwannomas can be difficult. In MRI can visualize abnormal uptake of contrast extending into the labyrinthine segment to the geniculate ganglion in facial nerve schwannomas and enlarged facial nerve canal.

Differential diagnosis:

We do fundamentally based on the anatomical site of nerve affections, enlarged relates foramen that said rib and the corresponding fat amyotrophy innervating muscles. VIII tumors are confined to the posterior fossa while the V cranial nerve is located at the boundary between the middle cranial fossa and posterior.

ARACHNOID CYST

They are benign congenital intracranial masses, filled LCR and of unknown origin. Not communicate with the ventricular system.

They tend to be unilocular, well defined and are shaped by the surrounding structures. Represent 1% of all intracranial masses.

They are more common in men.

They have an unknown formation mechanism may be due to: diverticulum or arachnoid division during development, active secretion of CSF by the cyst wall, slowly loosening by CSF pulsations and even trauma, mastoiditis, meningitis or subarachnoid hemorrhage.

They are generally stable over time, although there have been reports of rapid or progressive growth and spontaneous resolution.

Microscopically are formed by a membrane of collagen vascular arachnoid cells bounded by planar. Most are filled with clear liquid transparent.
Most are asymptomatic and are discovered incidentally. More rarely cause symptoms by mass effect on lower cranial nerves.

**Imaging findings:**

Extra-axial lesions are very well defined, you can move or deform the adjacent brain. No calcifications usually have capture nor contrast. They often produce scalloping adjacent bone.

In MRI showed signal intensity similar to CSF on all sequences. Occasionally may have hemorrhagic areas, high protein or no flow within the cyst (Figura 6).

**Differential diagnosis:**

The basic differential diagnosis must do with epidermoid cysts (Table 4).

Other differential diagnoses:

- Chronic subdural hematoma: typically show no signal intensity equal to CSF and often have a membrane captante.

- Porencephalic cyst: often follow a history of trauma or stroke. Brain are normally surrounded with gliosis.

**Diagnostic clues:** extra-axial lesion attenuation and signal intensity similar to CSF. Not restricted in distribution.

**VASCULAR INJURIES**

You can see the twists and ectasia or aneurysms in the APC produced by different vascular structures that cross (basilar artery, vertebral artery and some of its branches).

May amount to 3.4% of all lesions of APC, with most vertebral artery aneurysms and posterior inferior cerebellar artery. Aneurysms of the antero-inferior cerebellar arteries are very rare but not rare that there is a loop of the same is introduced by the acoustic pore without producing symptoms.

Most occur in middle age or young adults

These vascular changes may compress adjacent neural structures and cause neuropathies of cranial nerves VII or VIII.
**Imaging findings:**

CT and MR appear as round or oval mass with intense contrast enhancement and homogeneous (similar to other cerebral vessels) and without signal flow spin echo sequences. If the aneurysm is thrombosed can have mixed signal intensity or high on T1-weighted sequences (Figura 7). Sometimes it is possible to observe the mass uptake due to thrombus organization, which could lead to an erroneous diagnosis of schwannoma. Rarely are strict intracanalicular aneurysms, which can also be misconstrued as intracanalicular schwannomas.

Other vascular lesions that can be found at this level are the cavernoma, which can be intra-or extra-axial. Heterogeneous appearance presented both T1 sequences as in T2, and may show a peripheral rim of low signal intensity hemosiderin. Gadolinium uptake is variable.

The effect can also produce dolichoectasia mass at this level. Following the course identifies a tortuous dilated tubular structure that traverses the prepontine normal location in the midline of the basilar artery.

**Diagnostic clues:** saccular or spherical mass with uptake similar to other cerebral vessels and flow void signal in MRI.

**Images for this section:**
Fig. 1: MRI CAIS. Vestibular schwannoma. Image A: axial T2 FFE noncontrast coronal. Image B: DRIVE noncontrast. Images C and D: axial and coronal T1 contrast. Lesion in cone morphology with essentially intracanalicular component, hypo or isointense in images A and B and hyperintense on images C and D.
**Fig. 2:** MRI CAIS. Vestibular schwannoma. Axial T2-Scan B-FFE, T2 coronal image DRIVE B, Image C-axial TSE T2. Image D-TSE axial T1 with contrast. Lesion with oval morphology with predominantly cisternal component in APC left. It behaves as a mass or isointense hiccup in images A, B and C and captures image contrast intensely D.
Fig. 3: MRI CAIS. Vestibular schwannoma. Image A: TSE axial T1 with contrast, image B: B-FFE axial, image C: axial T2 TSE and image D: coronal T2-DRIVE. Lesion with morphology cone with cisternal and intracanalicular component located in APC right.
**Fig. 4:** Axial CT images without and after administration of intravenous contrast, which displays extra-axial lesion in left APC corresponding to meningioma.
**Fig. 5:** RM CAIS. Image A: coronal TSE-T2 sequence, image B: axial T2-TSE sequence, image C: DRIVE coronal sequence, image D: axial T1 sequence with contrast and image E: Diffusion axial sequence. Lesion in the left cerebellopontine angle, with signal intensity similar to CSF on all sequences that restricts in diffusion sequences. Epidermoid cyst.
**Fig. 6:** Image A: unenhanced CT. Image B: MRI, coronal T2 TSE sequence. Image C: MRI, axial, diffusion sequence. Picture D: MRI axial T2 TSE. Lesion in the right cerebellopontine angle with signal intensity similar to CSF on all sequences and not restricted in diffusion: arachnoid cyst.
Fig. 7: RM CAIS. Image A: axial FIESTA sequence. Image B: axial TOF sequence. Image C: coronal TOF sequence. Picture D: Axial T2 sequence. Vascular structure is appreciated origin mark on acoustic-facial packet corresponding to left vertebral artery elongation.
Conclusion

Given the frequency of adult onset of tumors of the cerebellopontine angle and the clinical importance of early diagnosis to enable a therapeutic approach as conservative as possible to avoid neurological sequelae, it is important that the radiologist knows in detail the anatomy and tumors more frequent in this region, having a list of differential diagnoses and simple schematic that allows to develop a fast and reliable information.

References


Personal Information