C. Interactive case discussion

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Learning objectives

1. To introduce typical cases illustrating the role of imaging modalities in the differential diagnosis of focal neurological symptoms.

2. To motivate the audience by the use of voting pads to be involved in the diagnostic process.

3. To highlight the conclusion that may be drawn on the basis of the discussed cases.
Main

Case Nr 1. A headache for 6 weeks in a young woman

A 32-year-old woman is complaining of a generalized but mostly occipital located, permanent headache for 6 weeks. It started gradually. She denies any head trauma, intense physical exertion, and changes in vision, or any other associated symptoms (other than periodical nausea). Her medical history is remarkable for congenital cardiac malformation: right to left shunt due to ventricular septal defect, stenosis of a pulmonal artery.

The neurologic examination reveals that she is fully alert, oriented. Her cranial nerves are intact. Motor strength is symmetrical. Cerebellar function and sensory systems are normal.

CT and MRI investigations are performed (Fig1 - Fig 6).

What is the diagnosis? Choose the right option!

1. Metastasis
2. Resolving hematoma
3. Focus of demyelination
4. Subacute infarction
5. Abscess

Hint: the patient has headache for 6 weeks and a history of congenital cardiac ventricular septal defect.

Radiological key of diagnosis: signal intensity (SI) on DWI

Case Nr 2. Complex partial seizures in a young woman

A 19-year-old woman is complaining of complex partial seizures one to four times a day, some of which generalize secondarily, since late childhood. The neurologic examination does not reveal focal neurological symptoms. On EEG the epileptogenic focus involves structures of the mesial temporal lobe.

Two MRI investigations were performed with the one year interval (Fig 7- Fig18).

What is the diagnosis? Choose the right option!
1. Cortical glioma
2. Virus encephalitis
3. Mesial temporal sclerosis
4. Focal cortical dysplasia: focal macrogyria

**Hint:** the patient has seizures since late childhood.

**Radiological key of diagnosis:** appearance, location of focus, its SI on T1 FSPGR IR WI, FLAIR and T2 FSE WI on primary and follow-up MRI

**Case Nr 3. A Headache and complex partial seizures in a young woman**

A 17-year-old woman presents with periodical headache, complex partial seizures with secondarily generalization one to two times a week since age of 3. Her medical history is remarkable for purulent meningoencephalitis on age three.

The neurologic examination does not show focal neurological symptoms.

Two MRI investigations were performed with the interval of 12 months (Fig 19-Fig 32).

What is the diagnosis? Choose the right option!

1. Cortical glioma
2. Virus encephalitis
3. Focal cortical dysplasia - macrogyria
4. Cortical scars after CNS infection in the childhood

**Hint:** The patient has seizures since childhood and a history of CNS infection on age 3.

**Radiological key of diagnosis:** imaging morphology and SI of foci, no MRI changes on follow-up MRI scans.

**Case Nr 4. A headache and vision disturbances in a young woman**

A 37-year-old woman presents with headache, vision disturbances, skin dryness, polyuria, urine incontinence, and diabetes. The ophthalmologic examination reveals bitemporal hemianopsia.

CT and MRI investigations were performed (Fig.33-Fig.39).

What is the diagnosis? Choose the right option!
1. Epidermoid
2. Teratoma
3. Pituitary apoplexy
4. Craniopharyngeoma

**Hint:** the patient has headache, vision disturbances and endocrinological symptoms.

**Radiological key of diagnosis:** characteristic location, density on CT and SI on MRI, sellar size and its content on sagittal T1.

**Case Nr 5. A headache and vision disturbances in a young woman**

A 27-year-old woman is complaining of periodical headache and vision disturbances for one month. She denies any head trauma or intense physical exertion. Her regular medications are hormonal drugs which she has been used due to dysmenorrhea for about one year. The neurologic examination does not show focal neurological symptoms other than bitemporal hemianopsia.

MRI investigation is performed (Fig. 40-Fig.44).

What is the diagnosis? Choose the right option!

1. Craniopharyngeoma
2. Suprasellar lipoma
3. Pituitary apoplexy
4. Xanthogranuloma
5. Thrombosed aneurysm

**Hint:** the patient has headache, vision disturbances and endocrinological symptoms.

**Radiological key of diagnosis:** characteristic location and SI, sellar size and content on sagittal T1.

**Case Nr 6. Nausea and vision disturbances in a young man**

A 35-year-old man presents with a two day history of sudden vision disturbances, dizziness and nausea first time in his live. He denies any head trauma, fever, any prior surgeries, drug, and nicotine or alcohol abuse. The patient links his complaints with intense physical exertion and long-drawn stress. The neurologic examination reveals light sensory deficit on the left.

MRI investigation is performed (Fig.45-Fig.49).
What is the diagnosis? Choose the right option!

1. Hemorrhagic neoplasm
2. Oligodendroglioma
3. Old trauma
4. Capillary teleangiectasias
5. Cavernous angioma

**Hint:** The patient has sudden onset of certain neurological complaints for two days.

**Radiological key of diagnosis:** SI; no contrast enhancement; typical appearance.

**Case Nr 7. Progressive dysarthria and vision disturbances in a 67-year-old man**

A 67-year-old man presents with progressive symptoms of midbrain and brainstem lesion: dysarthria, duplication, dizziness during last two years. His medical history is remarkable for hemorrhagic infarction in basal ganglia four years ago. The neurologic examination reveals eyes movement disturbances, dysarthria, instability, and motor deficit on the left.

MRI investigation is performed (Fig.50-Fig.57).

What is the diagnosis? Choose the right option!

1. Amyotrophic lateral sclerosis
2. Multiple sclerosis
3. Wallerian degeneration
4. Hypertrophic olivary degeneration
5. Wilson disease

**Hint:** gradually progressive symptoms of midbrain and brainstem lesion four years after basal ganglia infarction.

**Radiological key of diagnosis:** unilateral degeneration of corticospinal tract.

**Case Nr 8. A headache and weakness in a young woman**

A 28-year-old woman is complaining of headache and progressive weakness, instability for two months. She denies any head trauma, intense physical exertion, fever, any prior surgeries, drug, and nicotine or alcohol abuse. Her medical history is remarkable for liver cirrhosis, portal hypertension, varicose of esophagus. The neurologic examination reveals dyskinesia, dystonia, asymmetric tremor more pronounced on the right, irritability, emotional lability, and depression.
MRI is performed (Fig.58-Fig.69).

What is the diagnosis? Choose the right option!

1. Leigh disease  
2. Wilson disease  
3. Carbon monoxide poisoning  
4. Creutzfeldt-Jakob disease  
5. Striatonigral degeneration

**Hint:** young patient has headache, progressive weakness, instability in combination with liver cirrhosis.

**Radiological key of diagnosis:** symmetrical, typical lesions on T2, DWI, DTI

**Case Nr 9. Coordination disturbances and "unclear head" in a 45-year-old man**

A 45-year-old man presents with coordination disturbances and "unclear head" for 3 days. He denies any head trauma, fever, drug, and nicotine or alcohol abuse. His medical history is remarkable for acute interstitial nephritis and arterial hypertension. The neurologic examination does not show focal neurological symptoms.

MRI investigation is performed (Fig.69-Fig.81).

What is the diagnosis? Choose the right option!

1. Acute cerebral ischemia  
2. Gliomatosis cerebri  
3. ADEM  
4. Multiple sclerosis  
5. Posterior reversible encephalopathy syndrome (PRES)

**Hint:** The patient suffers from arterial hypertension, have cerebral complaints for 3 days without focal neurology.

**Radiological key of diagnosis:** characteristic distribution of lesions, SI on T2, FLAIR and DWI.

**Case Nr 10. A sleepiness, dizziness, partial disorientation and cognitive disturbances in 62-year-old women**
A 62-year-old woman presents with sudden onset of sleepiness, dizziness, and partial disorientation which appeared during the episode of arterial hypertension and persists for 6 days with a tendency of gradual clinical improvement. She denies any head trauma, any prior surgeries, intense physical exertion or abuse of alcohol. Her medical history is remarkable for arterial hypertension, diabetes, and obesity. The neurologic examination does not show focal neurological symptoms other than light ataxia on the right, and eyes movement disturbances.

MRI was performed at the sixth day of the illness (Fig.82-Fig.86).

What is the diagnosis? Choose the right option!

1. Venous infarction
2. PRES
3. ADEM
4. Thrombembolic arterial infarction
5. Encephalitis

**Hint:** the patient has sudden onset of sleepiness, dizziness and disorientation, and negative history for intoxication, or trauma.

**Radiological key of diagnosis:** characteristic distribution of lesions, SI on T2, FLAIR and DWI.
Fig. 0: Case Nr 1. Non contrast CT: hypodense mass with moderate vasogenic edema and mass effect in the right parietal lobe

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**Fig. 0:** Case Nr 1. Post contrast CT: central low density area, peripheral rim enhancement, the deepest part is the thinnest, the thickest near to cortex

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Fig. 0: Case Nr 1. MRI FLAIR: hyperintense center, hypointense rim, moderate perifocal edema

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**Fig. 0**: Case Nr 1. MRI DWI: increased signal intensity within pathological focus

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Fig. 0: Case Nr 1. MRI T1 FSPGR IR WI: rim isointense to WM; center hiperintense to CSF

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Fig. 0: Case Nr 1. MRI Post contrast T1 FSPGR IR WI: well-defined, thin walled enhancing rim

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**Fig. 0:** Case Nr 2. T1 FSPGR IR WI: enlargement of the hippocampus and parahippocampal gyrus, isointense to adjacent and contralateral cortex.

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**Fig. 0:** Case Nr 2. T1 FSPGR IR WI: enlargement of the hippocampus and parahippocampal gyrus, isointense to adjacent and contralateral cortex.

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Fig. 0: Case Nr 2. Post contrast T1 FSPGR IR WI: enlargement of the hippocampus and parahippocampal gyrus, no contrast enhancement

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**Fig. 0:** Case Nr 2. T2 FSE WI: enlargement of the hippocampus and parahippocampal gyrus, isointense to adjacent and contralateral cortex.

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**Fig. 0:** Case Nr 2. T2 FSE WI: enlargement of the hippocampus and parahippocampal gyrus, isointense to adjacent and contralateral cortex.

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**Fig. 0:** Case Nr 2. T2 FSE WI: enlargement of the hippocampus and parahippocampal gyrus, isointense to adjacent and contralateral cortex.

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Fig. 0: Case Nr 2. FLAIR: enlargement of the hippocampus and parahippocampal gyrus, slightly hyperintense to adjacent and contralateral cortex.

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**Fig. 0:** Case Nr 2. FLAIR: enlargement of the hippocampus and parahippocampal gyrus, slightly hyperintense to adjacent and contralateral cortex.

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Fig. 0: Case Nr 2. FLAIR: enlargement of the hippocampus and parahippocampal gyrus, slightly hyperintense to adjacent and contralateral cortex.

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Fig. 0: Case Nr 2. Follow-up MRI T1 FSPGR IR WI after one year

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Fig. 0: Case Nr 2. Follow-up MRI T2 FSE WI after one year

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Fig. 0: Case Nr 2. Follow-up MRI T2 FSE WI after one year

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**Fig. 0:** Case Nr 3. MRI 2009, FLAIR: focal cortical triangularly shaped hyperintense lesion in the medium, inferior frontal gyri and adjacent subcortical white matter

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Fig. 0: Case Nr 3. MRI 2009, FLAIR:focal enlargement of the inferior frontal gyrus is seen. The second subtle hyperintense lesion without mass effect is seen in the parietal white matter subcortically.
Fig. 0: Case Nr 3. MRI 2009, T1 FSPGR IR WI: focal enlargement and thickening of the inferior frontal gyrus. Blurred border with the adjacent white matter.
Fig. 0: Case Nr 3. MRI 2009, T1 FSPGR IR W: focal enlargement and thickening of the inferior frontal gyrus.

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Fig. 0: Case Nr 3. Follow-up MRI 2010, FLAIR

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Fig. 0: Case Nr 3. Follow-up MRI 2010, FLAIR

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**Fig. 0:** Case Nr 3. Follow-up MRI 2010, FLAIR

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Fig. 0: Case Nr 3. Follow-up MRI 2010, T2 FSE WI

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Fig. 0: Case Nr 3. Follow-up MRI 2010, T2 FSE WI

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Fig. 0: Case Nr 3. Follow-up MRI 2010, T1 FSPGR IR WI

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Fig. 0: Case Nr 3. Follow-up MRI 2010, T1 FSPGR IR WI

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Fig. 0: Case Nr 3. Follow-up MRI 2010, Multivoxel MRS: chosen area of investigation

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Fig. 0: Case Nr 3. Follow-up MRI 2010, Multivoxel MRS: decrease in NAA/Ch and NAA/Cr ratios

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Fig. 0: Case Nr 4. Non enhanced CT: hypodense rounded cystic mass in the supra/parasellar region, droplets of the content are disseminated in basal cisterns. Obstructive hydrocephalus.

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**Fig. 0:** Case Nr 4. MRI FLAIR: heterogeneous SI in lobulated rounded supra/parasellar mass, high SI droplets in basal cisterns.

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Fig. 0: Case Nr 4. MRI FLAIR: "#upture droplets" in ventricles are very hyperintense.

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Fig. 0: Case Nr 4. MRI Non contrast T1 FSPGR IR WI: heterogeneous SI in lobulated rounded supra/parasellar mass, high SI droplets in basal cisterns.

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Fig. 0: Case Nr 4. MRI Post contrast T1 FSPGR IR WI: contrast enhancement in the capsula

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**Fig. 0:** Case Nr 4. MRI Post contrast SE WI with fat suppression: Capsular enhancement, drop of SI in the content of lesion.

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Fig. 0: Case Nr 4. MRI Post contrast SE WI with fat suppression: Capsular enhancement, drop of SI in the content of lesion.

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**Fig. 0:** Case Nr 5. MRI FLAIR: hyperintense rounded lesion in the suprasellar cistern.

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Fig. 0: Case Nr 5. MRI T2 FSE WI: inhomogenous hyperintense endo- and suprasellar upward extended mass of "figure-of-eight" or "snowman" appearance with hypointense rim.

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Fig. 0: Case Nr 5. MRI T1 SE WI: inhomogenous hyperintense endo- and suprasellar upward extended mass of "figure-of- eight" or "snowman" appearance

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Fig. 0: Case Nr 5. MRI Post contrast T1 SE WI: contrast enhancement in the capsula and solid endosellar part of lesion.

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Fig. 0: Case Nr 5. MRA 3D TOF MIP

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Fig. 0: Case Nr 6. MRI T1 FSPGR IR WI: well-delineated round reticulated "popcorn-like" lesion with mixed signal core and inhomogenous hypointense rim in the right subcortical parietal region.

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Fig. 0: Case Nr 6. MRI Post contrast T1 FSPGR IR WI: no contrast enhancement in the lesion.

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Fig. 0: Case Nr 6. MRI FLAIR: round reticulated "popcorn-like" lesion with mixed signal core, hypointense rim and radial perifocal susceptibility effect (lesion "blooms") in the right subcortical parietal region.

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**Fig. 0:** Case Nr 6. MRI T2* GRE: round lesion with mixed signal core, and radial susceptibility effect (lesion "blooms") in the right subcortical parietal region.

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Fig. 0: Case Nr 6. MRI DWI: rounded lesion with high signal core, and radial susceptibility effect (lesion "blooms") in the right subcortical parietal region.

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**Fig. 0:** Case Nr 7. MRI T2 FSE WI: hypointensity and atrophy in thalamus and in the central part of internal capsule

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**Fig. 0:** Case Nr 7. MRI T2 FSE WI: hyperintensity of pyramidal tract and hemiatrophy of brainstem.

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Fig. 0: Case Nr 7. MRI FLAIR: hypointensity and atrophy in thalamus and in the central part of internal capsule

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**Fig. 0**: Case Nr 7. MRI FLAIR: hyperintensity of pyramidal tract and hemiatrophy of brainstem.

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Fig. 0: Case Nr 7. MRI Post contrast T1 FSPGR IR WI: hypointensity of pyramidal tract and hemiatrophy of brainstem, no contrast enhancement of the affected area

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**Fig. 0:** Case Nr 7. MRI Post contrast T1 FSPGR IR WI: no contrast enhancement in the affected area.

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Fig. 0: Case Nr 7. MRI DTI: reduced fractional anisotropy (FA) in the affected area of cerebral peduncle

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Fig. 0: Case Nr 7. MRI DTI tractography: disintegration and partial disruption of CST.

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Fig. 0: Case Nr 8. MRI FLAIR: symmetrical hyperintensities in corticospinal tracts at the level of midbrain; hyperintensity in periaqueductal grey matter, pontine tegmentum.

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Fig. 0: Case Nr 8. MRI FLAIR: symmetrical hyperintensity and mixed SI with hyperintense rim in putamina, hyperintensity in both thalami.

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Fig. 0: Case Nr 8. MRI DWI: hypointensities in putamina, mixed SI in corticospinal tracts at the level of midbrain.

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**Fig. 0:** Case Nr 8. MRI DWI: hypointensities in caudate nuclei, putamina, hyperintensity in both thalami.

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Fig. 0: Case Nr 8. MRI T1 FSPGR IR: inhomogenous hypointensities in putamina

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**Fig. 0:** Case Nr 8. MRI Post contrast T1 FSPGR IR: hypointensities in both thalami, no pathological contrast enhancement

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Fig. 0: Case Nr 8. MRI T2 FSE: symmetrical hyperintensities in corticospinal tracts at the level of midbrain and both thalami

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Fig. 0: Case Nr 8. MRI DTI, chosen areas of tractography

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**Fig. 0:** Case Nr 8. MRI DTI, corticospinal tractography: abnormal posterior portion of posterior limb of internal capsule, middle division of cerebral peduncle and base of pons

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**Fig. 0:** Case Nr 8. MRI, multivoxel MRS: chosen area of investigation

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Fig. 0: Case Nr 8. MRI, multivoxel MRS: reduced ratio of N-acetyl aspartate/creatine and Choline/creatine ratio in posterior limb of internal capsule.

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Fig. 0: Case Nr 9. MRI T2 FSE: patchy quite symmetrical hyperintensities in the middle and upper cerebellar peduncles

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Fig. 0: Case Nr 9. MRI T2 FSE: patchy quite symmetrical white matter hyperintensities, predominantly located in the central part and posterior limbs of internal capsule

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Fig. 0: Case Nr 9. MRI T2 FSE: patchy quite symmetrical white matter hyperintensities, predominantly located in the central part and posterior limbs of internal capsule

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Fig. 0: Case Nr 9. MRI FLAIR: patchy quite symmetrical hyperintensities in the middle and upper cerebellar peduncles

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**Fig. 0:** Case Nr 9. MRI FLAIR: patchy white matter hyperintensities, predominantly located in the central part and posterior limbs of internal capsule

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Fig. 0: Case Nr 9. MRI FLAIR: patchy white matter hyperintensities, predominantly located in the central part and posterior limbs of internal capsule

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Fig. 0: Case Nr 9. MRI DWI: lesions are isointense with normal WM

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Fig. 0: Case Nr 9. MRI DWI: lesions are isointense with normal WM

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**Fig. 0:** DWI: in general, lesions are isointense with normal WM; subtle hyperintensity in the central part of internal capsule on the left ("through shining effect").

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**Fig. 0:** Case Nr 9. MRI T1 FSPGR IR: lesions are isointense with normal WM

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**Fig. 0:** Case Nr 9. MRI T1 FSPGR IR: lesions are slightly hyperintense with normal WM

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**Fig. 0:** Case Nr 9. MRI T1 FSPGR IR: lesions are slightly hyperintense with normal WM

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**Fig. 0:** Case Nr 9. MRI Post contrast T1 FSPGR IR: subtle light patchy contrast enhancement of lesions in the left side white matter

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**Fig. 0:** Case Nr 10. MRI FLAIR: small bilateral hyperintensities in the medial parts of midbrain.

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**Fig. 0:** Case Nr 10. MRI FLAIR: hyperintensity in both thalami, more pronounced on the right.

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Fig. 0: Case Nr 10. MRI T2 FSE: bilateral hyperintensities in the medial parts of midbrain and both thalami, more pronounced on the right.

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**Fig. 0:** Case Nr 10. MRI DWI: bilateral hyperintensities in the medial parts of midbrain

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Fig. 0: Case Nr 10. MRI DWI: hyperintensities in both thalami, more pronounced on the right.

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