



Peaaju põletikulised haigused

Äli Tõnnov

SA PERH

Radioloogiakeskus

Neuroinfektsioonid

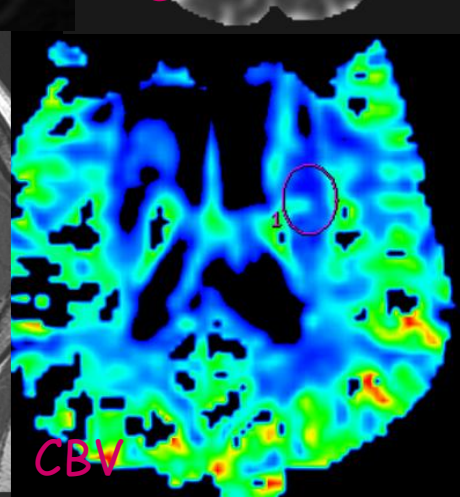
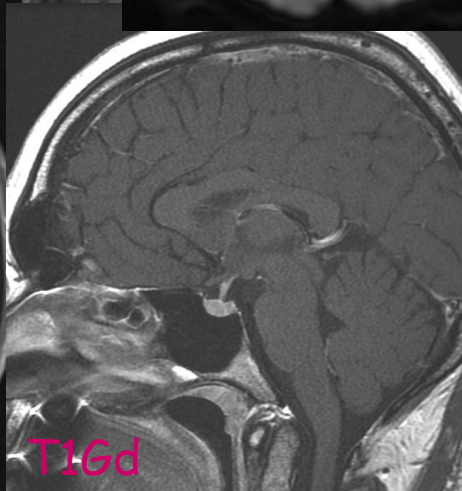
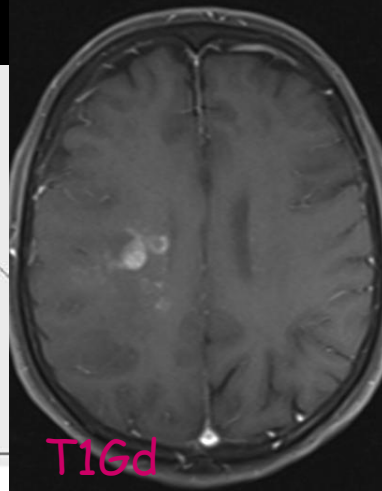
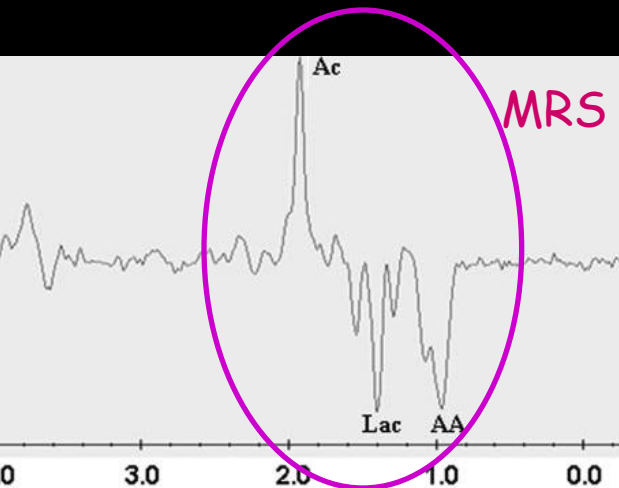
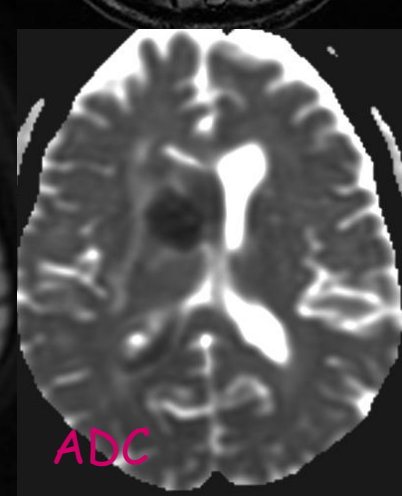
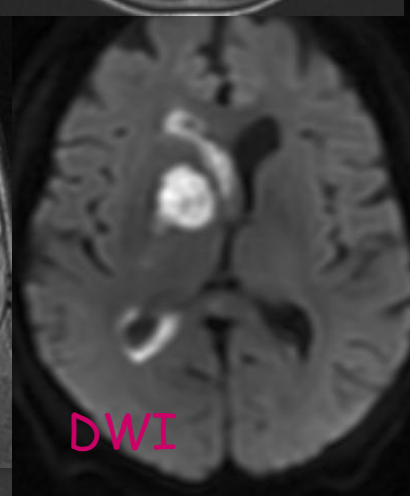
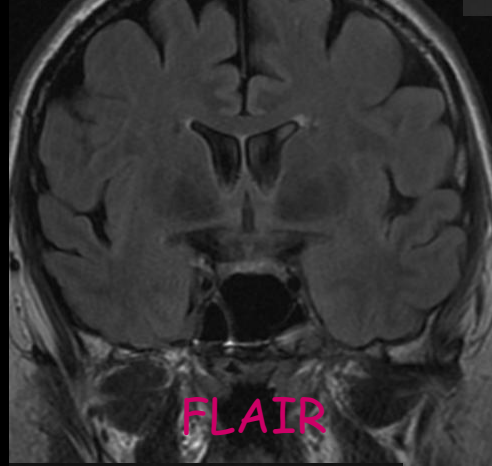
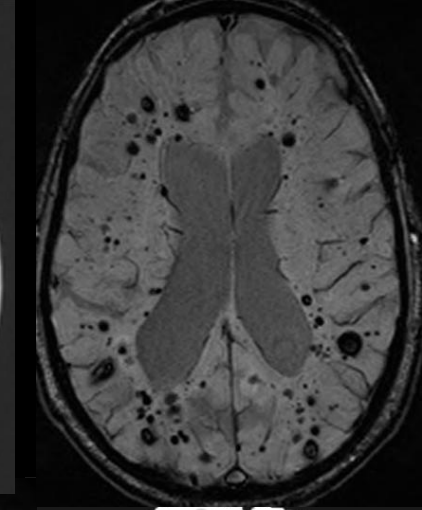
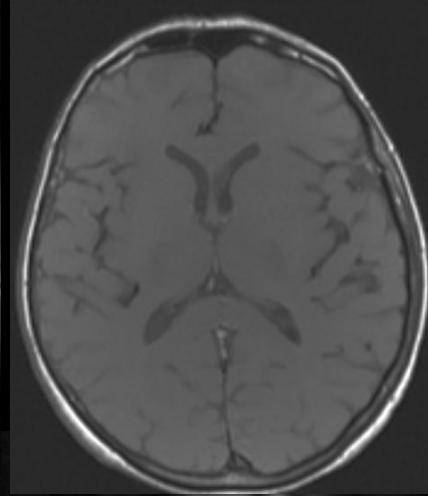
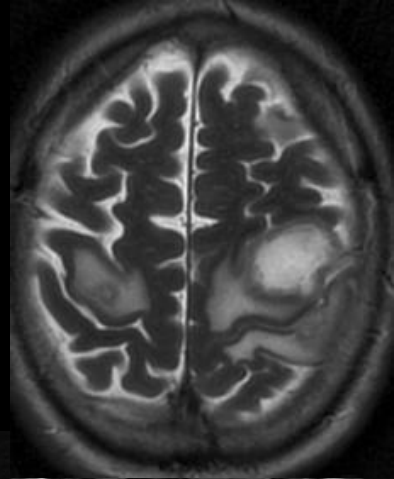
- Viimastel aastatel haigestumuse tõus ca 15 %
- AIDS ja immunosupressioon vähi ravis
- Oluline kiire diagnoos
 - Ravitav
 - Ravi puudusel kiired komplikatsioonid

Neuroinfektsioonide radioloogiline kuvamine

- Anamnees
- Soodustavad faktorid
- Kliiniline leid
- Liikvori analüüs, biopsia, laborileid
 - KT - komputertomograafia
 - MRT - magnetresonantstomograafia
 - Gd, DWI, perfusioon, MRS

MRT protokoll

- T2 axial
- T1 axial
- FLAIR ax/cor
- DWI/ADC
- T2*
- T1 Gd ax, cor, sag
- **DDX**
- Perfusioon
- **MRS** laktaat, atsetaat, aminohappes



Neuroinfektsioonid

- **Tekitajad:**

- Bakterid
- Viirused
- Seened
- Parasiidid

- **Leviku teed:**

- Hematogeenne
- Otsene

- **Lokalisatsioon:**

- Ajukoos -
 - Lokaalne - abstsess, tsüst
 - Difuusne - entsefaliit
- Ajukatted -
 - meningiit, ependümiit, arahnoidiit
- Ajuväline -
subduraalne,
epiduraalne

Neuroinfektsioonid

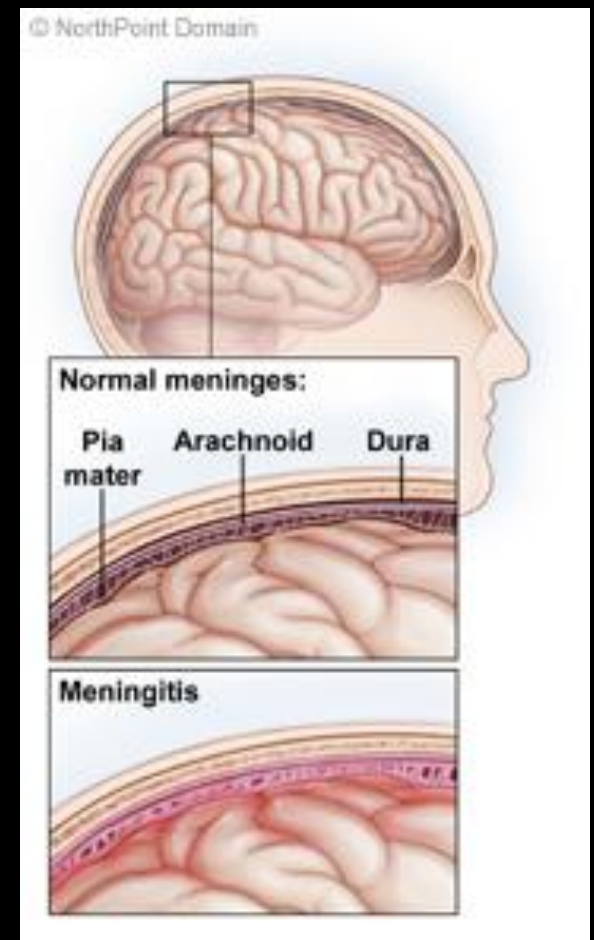
- Meningiit
- Abscess
- Ajuväliste ruumide põletik
- Entsefaliit
- Tsüstjad lesioonid
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- Neuroborrellioos, Lyme tõbi

Neuroinfektsioonid

- *Meningiit*
- Abscess
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Meningiit

- Leptomeningeaalne (pia ja arachnoidea) ja liikvori põletikuline protsess
- **Äge** - bakteriaalne - mädane
- **Lümfotsütaarne** - viiruslik
- **Krooniline** (4 nädalat)
 - TBC
 - Seened
 - Spiroheedid
 - Sarkoidoos



Meningiit

- **Diagnoos**

- Anamnees

- Kliiniline leid

- Peavalu, palavik, kaela kangus, fotofobia, oksendamine, teadvushäire jne.

- Subakuutne algus (1-7 päeva)

- **Liikvori laboratoorne analüüs**

- Oluline alustada ravi, mitte pildistada

Kuvamine

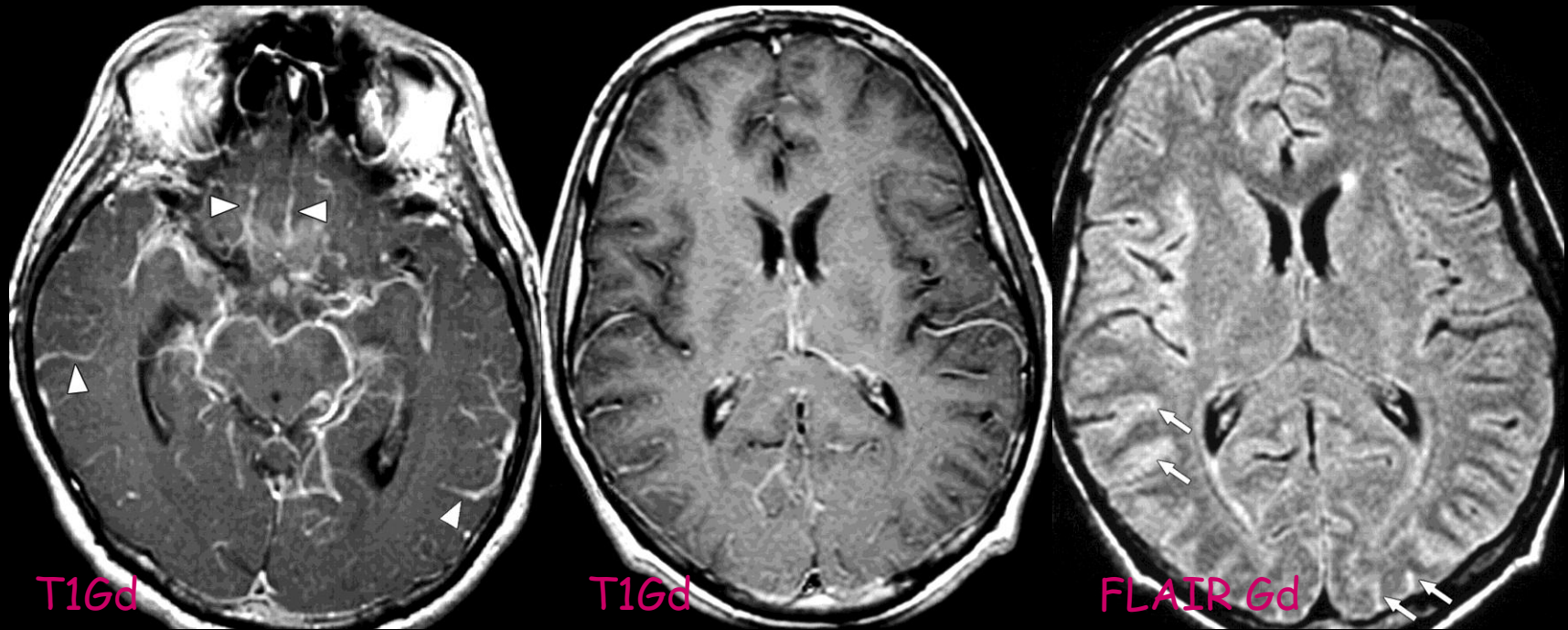
- Leid mittespetsiifiline
- Tüsistused 50%:
 - HC
 - Vaskulaarne tromboos
 - Aju infarkt
 - Aju abstsess
 - Empüeem
- DDX

Meningiit - radioloogiline leid

- Natiivuuring tihti leiuta
- KA-ga tekib leptomeningeaalne kontrasteerumine
 - Äge
 - suuraju pinnal, poolkerade vahel
 - Krooniline
 - basaaltsisternides, koljupõhimikul
- MRT KA-ga oluliselt tundlikum kui KT
 - FLAIR

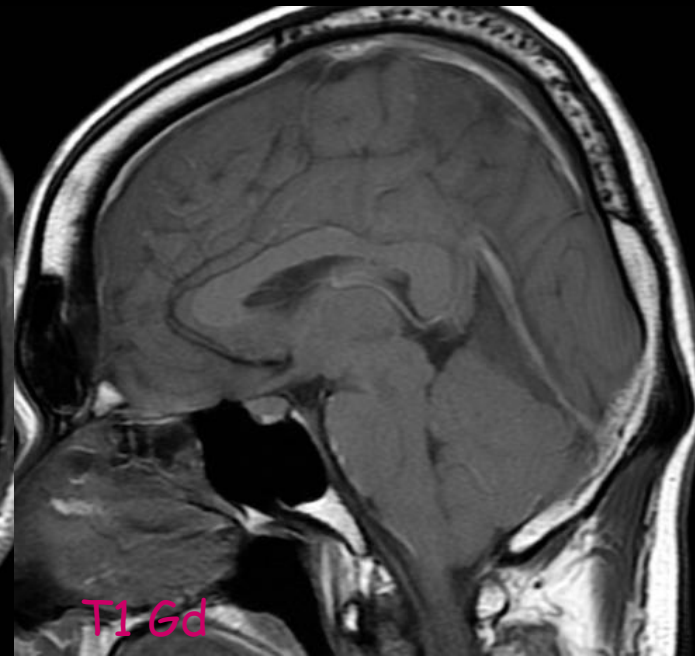
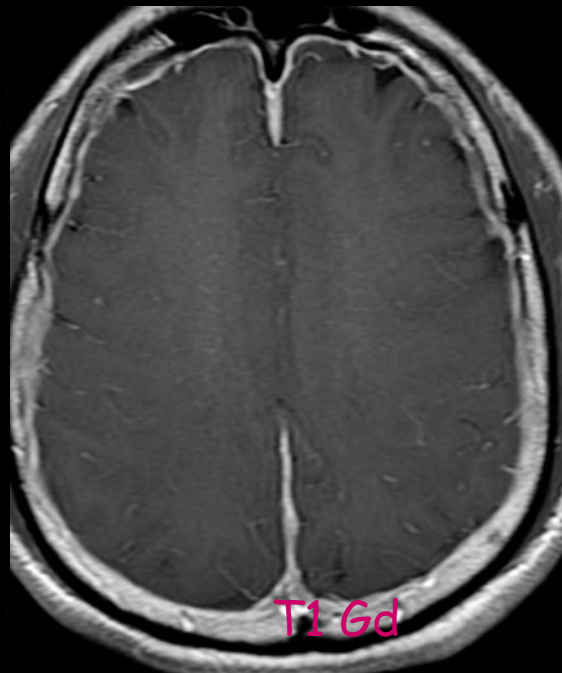
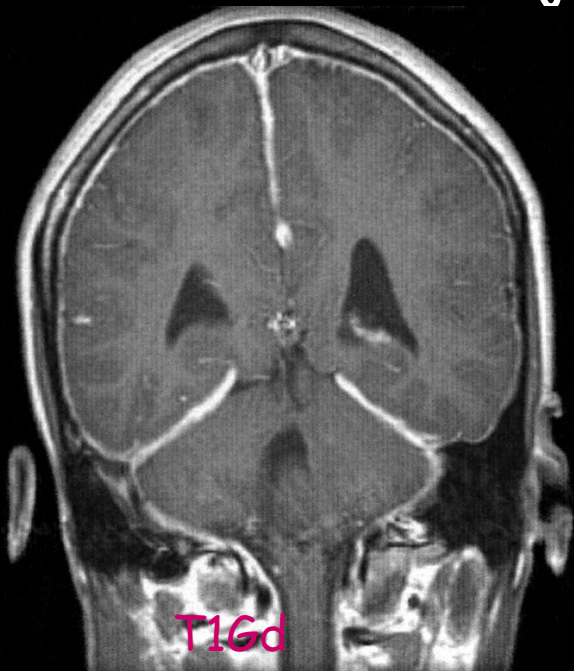
Meningiit - radioloogiline leid

- KA-ga intensiivne meningide kontrasteerumine
- FLAIR - ebamäärased signaalitõusuga alad - FLAIR postGd

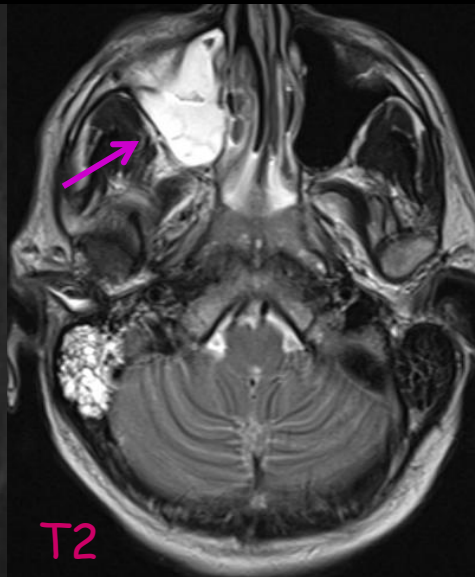
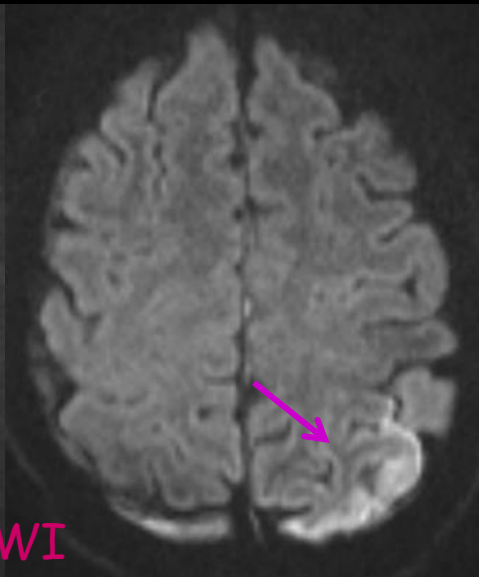


Ole ettevaatlik!

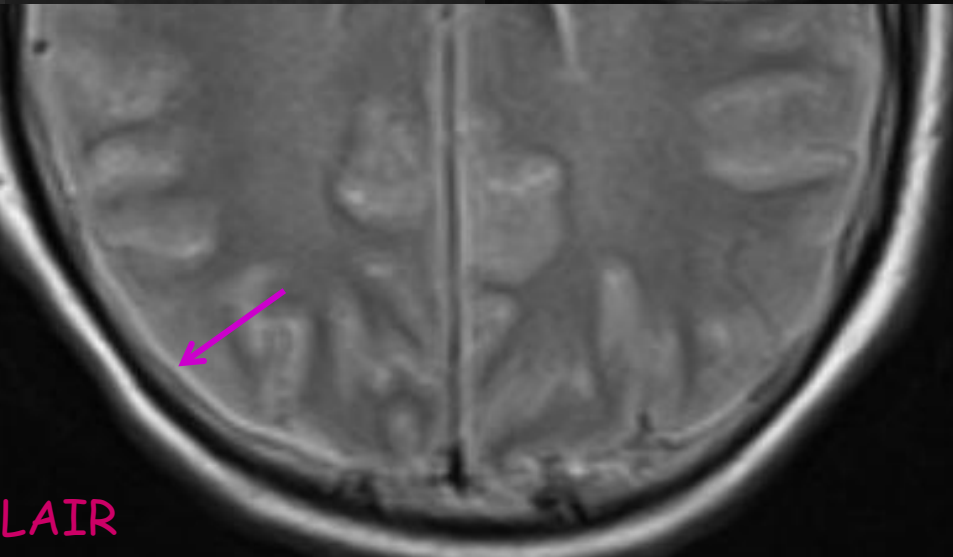
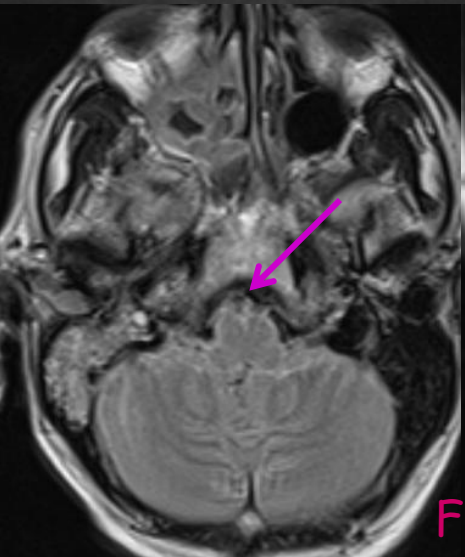
- Meningide kontrasteerumist põhjustab:
 - Iga meningide ärritus
 - Kraniotoomia, šunteerimine, SAH, kartsinomatoosne meningiit
 - Punktsioonijärgne hüpotensioon



Meningiit ←- otiit

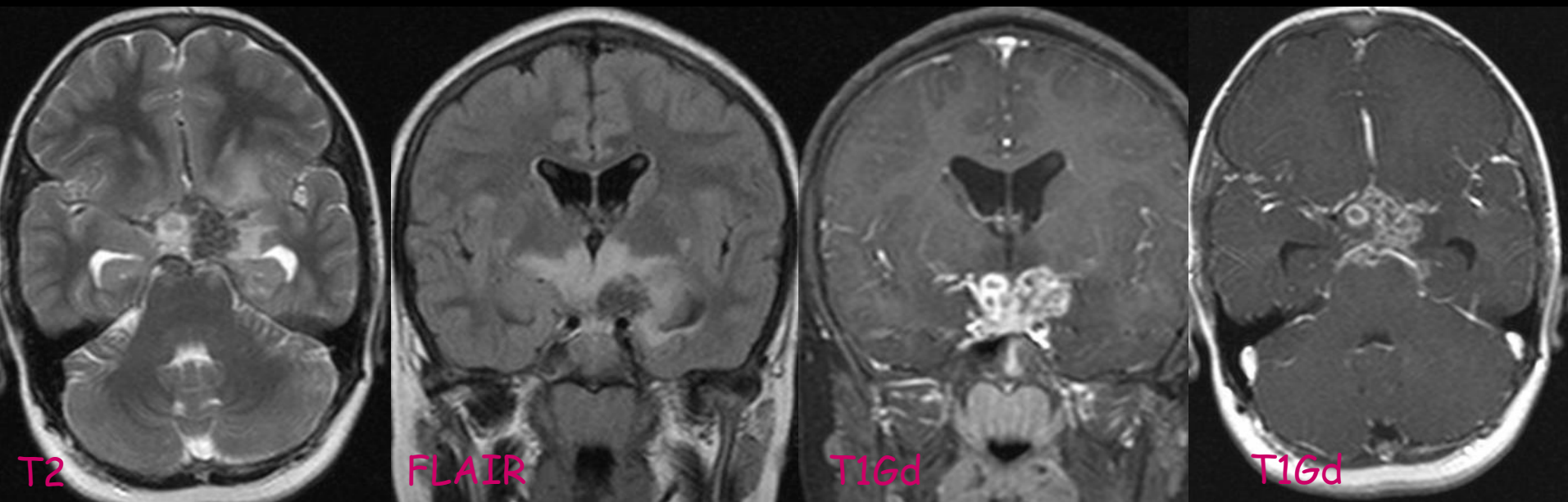


Otsi põhjust:
Sinusiit
Otiit
Mastoidiit



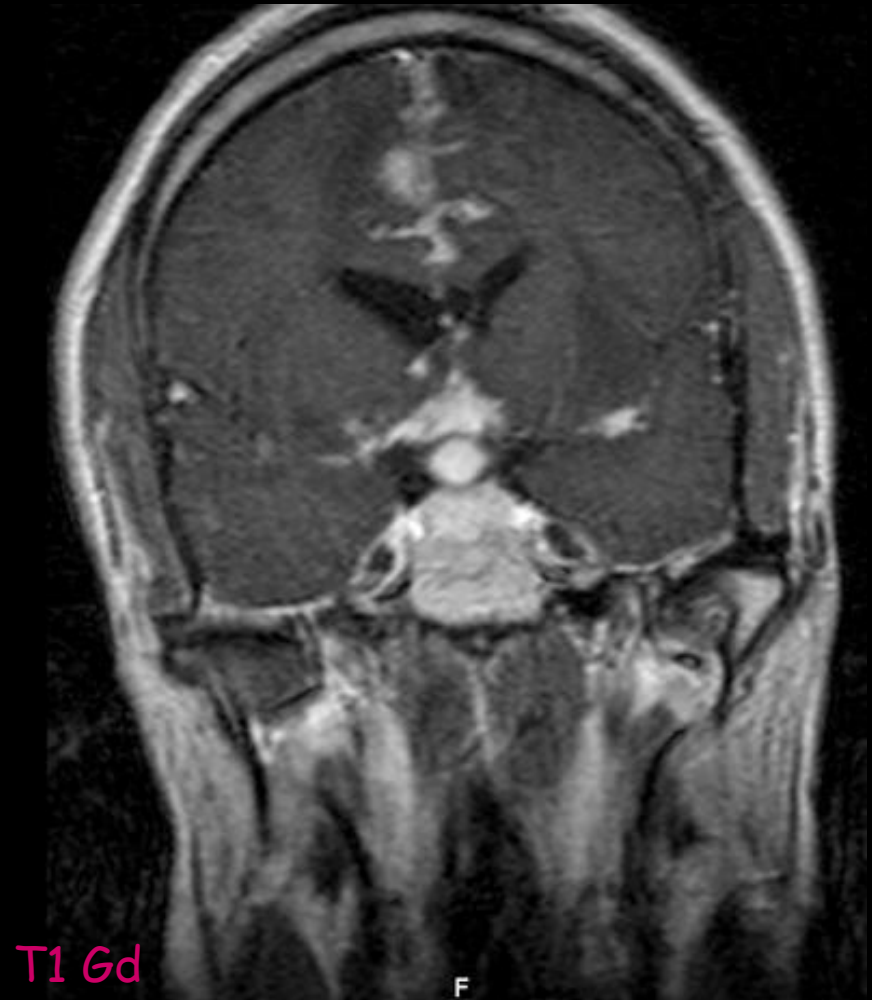
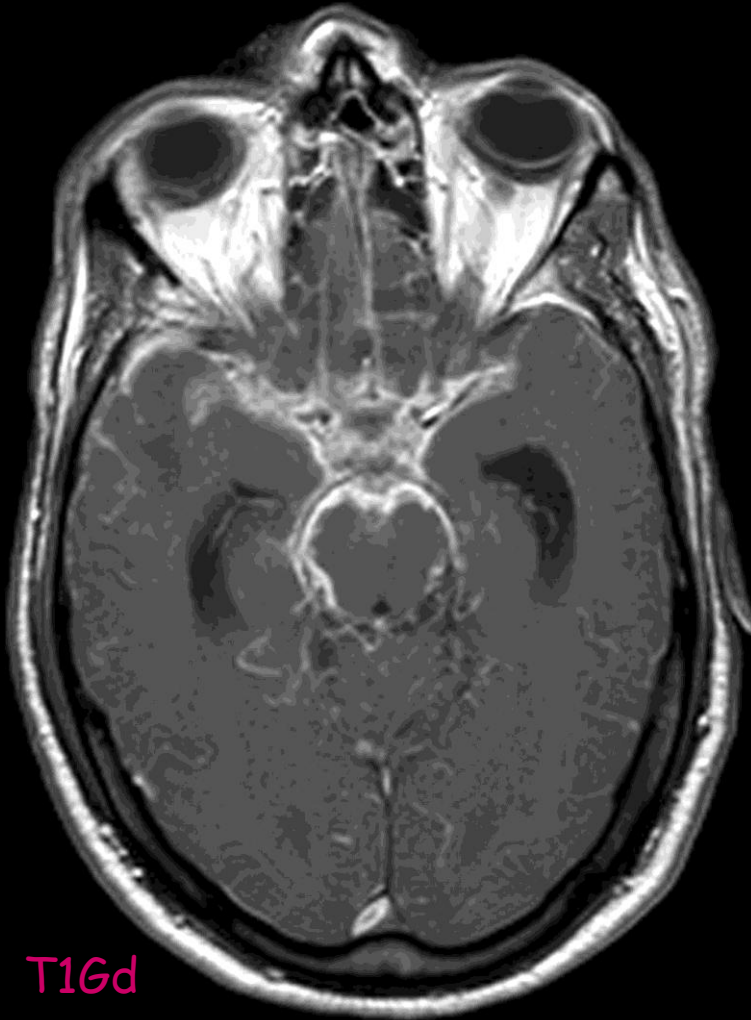
Meningiit MRT krooniline TBC

- *Mycobacterium tuberculosis* nakkus, tavaliselt sekundaarne - kops
- Tubekuloosne meningiit, harva tuberkuloomid, 5-10% haigetest
- DDX sarkoidoos - harva ajus kolded

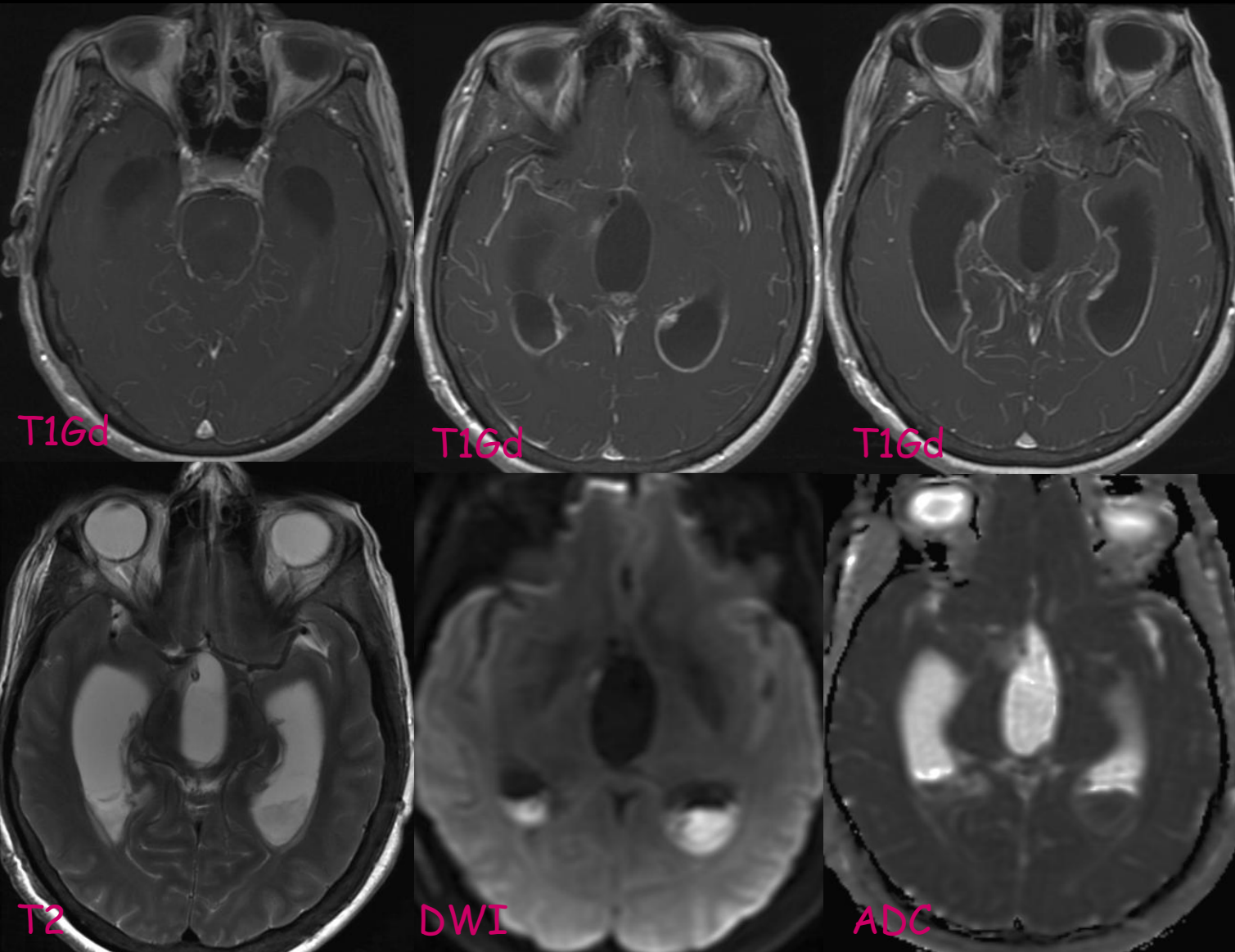


TBC meningiit

Neurosarkoidoos

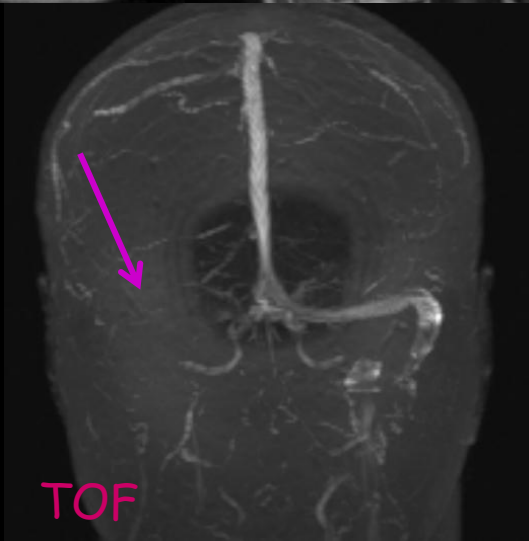
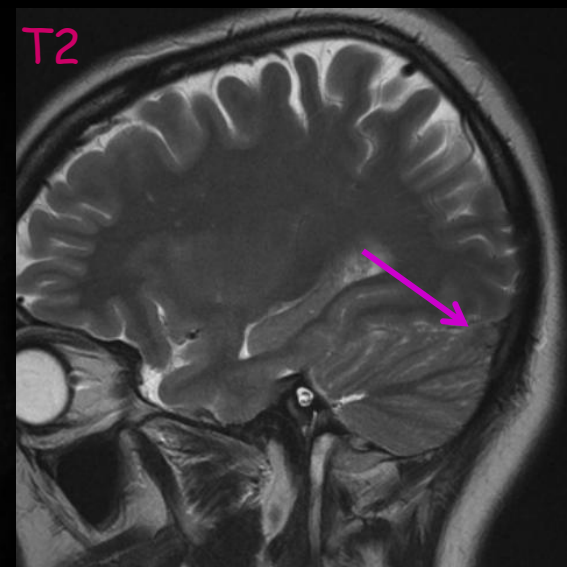
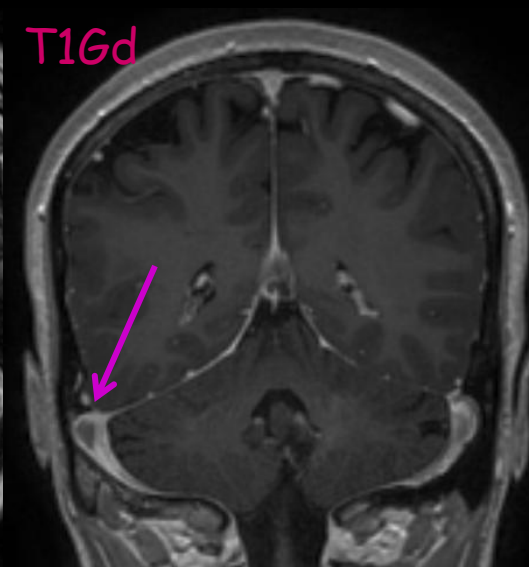
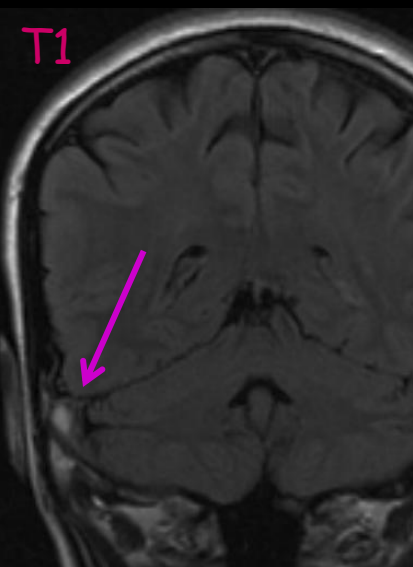


Meningiit - ventrikuliit



- Ependümiit
- Ventrikulaarne empüem
- Püotsefaalia
- Vatsakeste laienemine
- Sees mäda
- Suremus 40 - 80%

Tromboos



Neuroinfektsioonid peaaaju

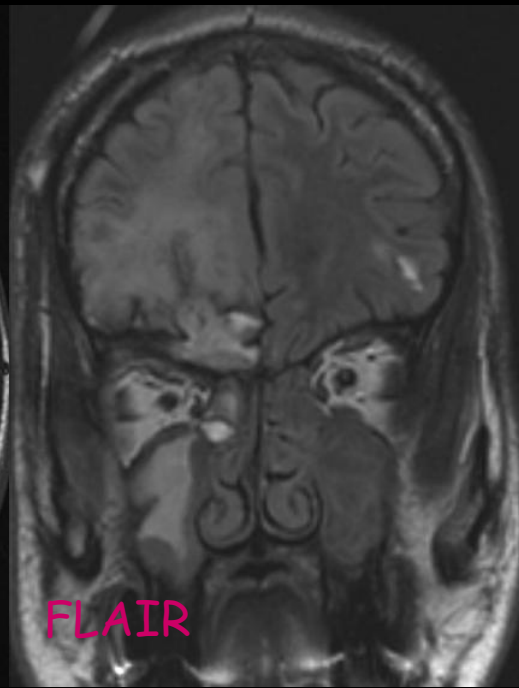
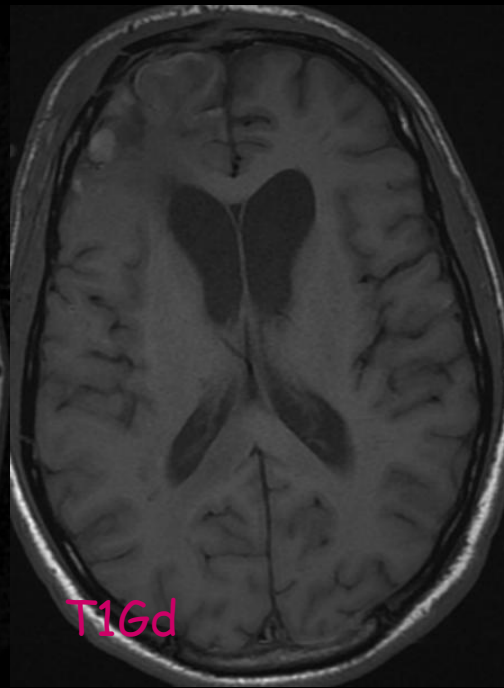
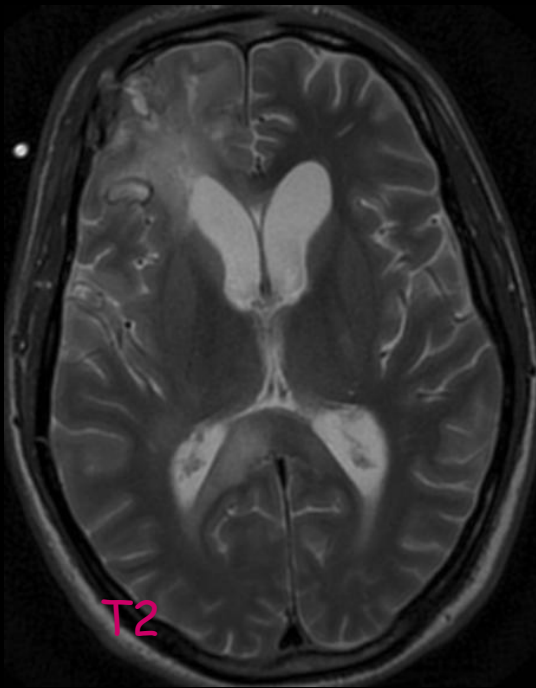
- Meningiit
- *Abstsess*
- Ajuväliste ruumide põletik
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Aju abstsess, bakteriaalne

- Infektsioon frontaalsiinuses või temporaalluus, meningiit - otsene levik
- Sepsis - hematogeenne levik
- Areng: 10-14 päeva
 - Lokaalne aju põletik - tserebriit
 - Keskosa nekroos
 - Perifokaalne ödeem
 - Kapsli moodustamine
- DDX Abstsess formeerub kiiremini kui tuumor ja aeglasemalt kui infarkt!

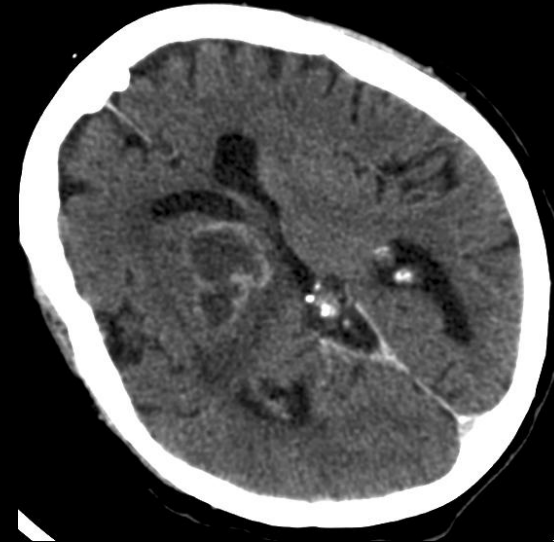
Tserebriit

- Lokalisatsioon sõltub etioloogiast, 5mm -> mõni cm
- Kõige varajases faasis ei pruugi kontrastteeruda



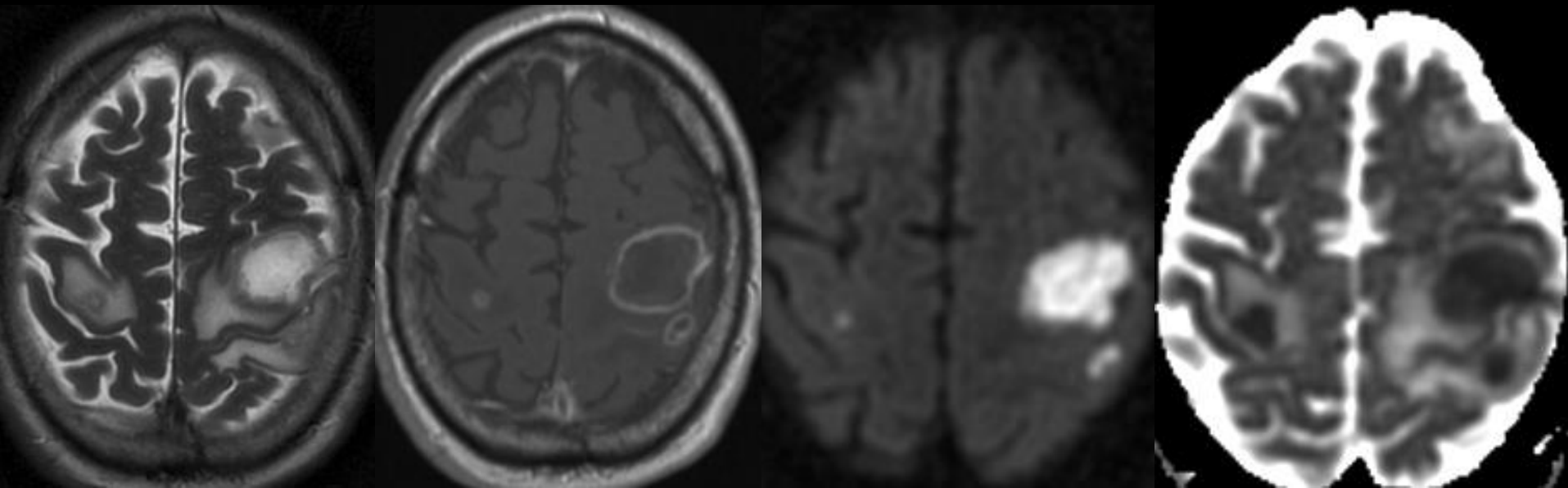
Abstsess - radioloogiline leid

- KT ringjas kontrasteeruv kolle
 - Kapsel õhuke, sile, harva ebatasane
- Keskosas nekroos, perifokaalne ödeem
- DDX
 - Nekroosiga kasvaja
 - Üksik MTS



Abstsess - radioloogiline leid

- Kapsel T2 hüpointensiivne
 - valgeainepoolselt õhem (kasvab VA suunas) oht ruptureeruda vatsakestesse
- KA-ga rõngjas kapsli kontrasteerumine
- DWI/ADC



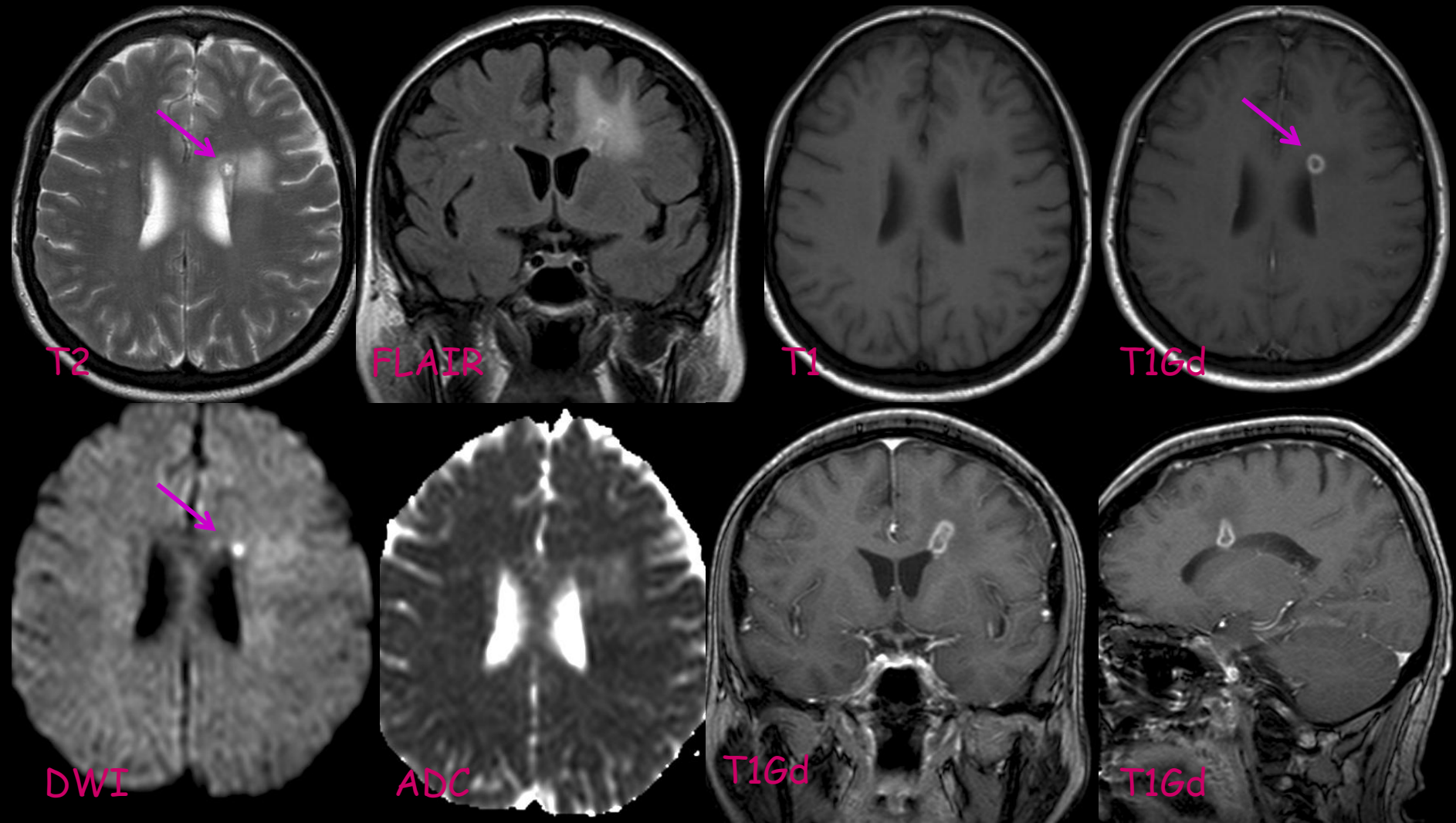
T2

T1 Gd

DWI

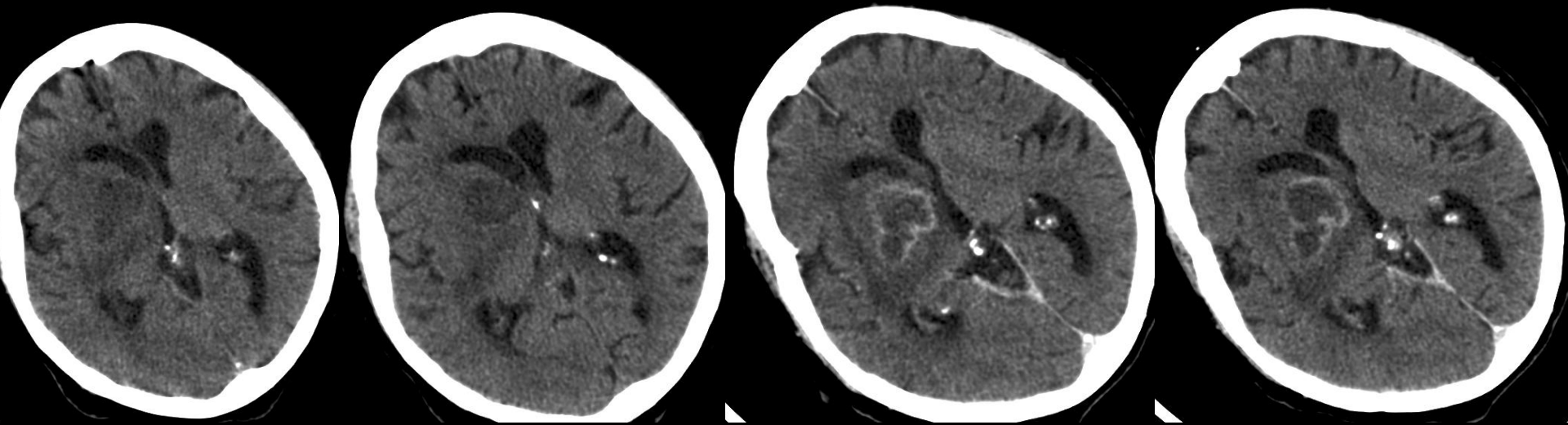
ADC

Abstsess - radioloogiline leid



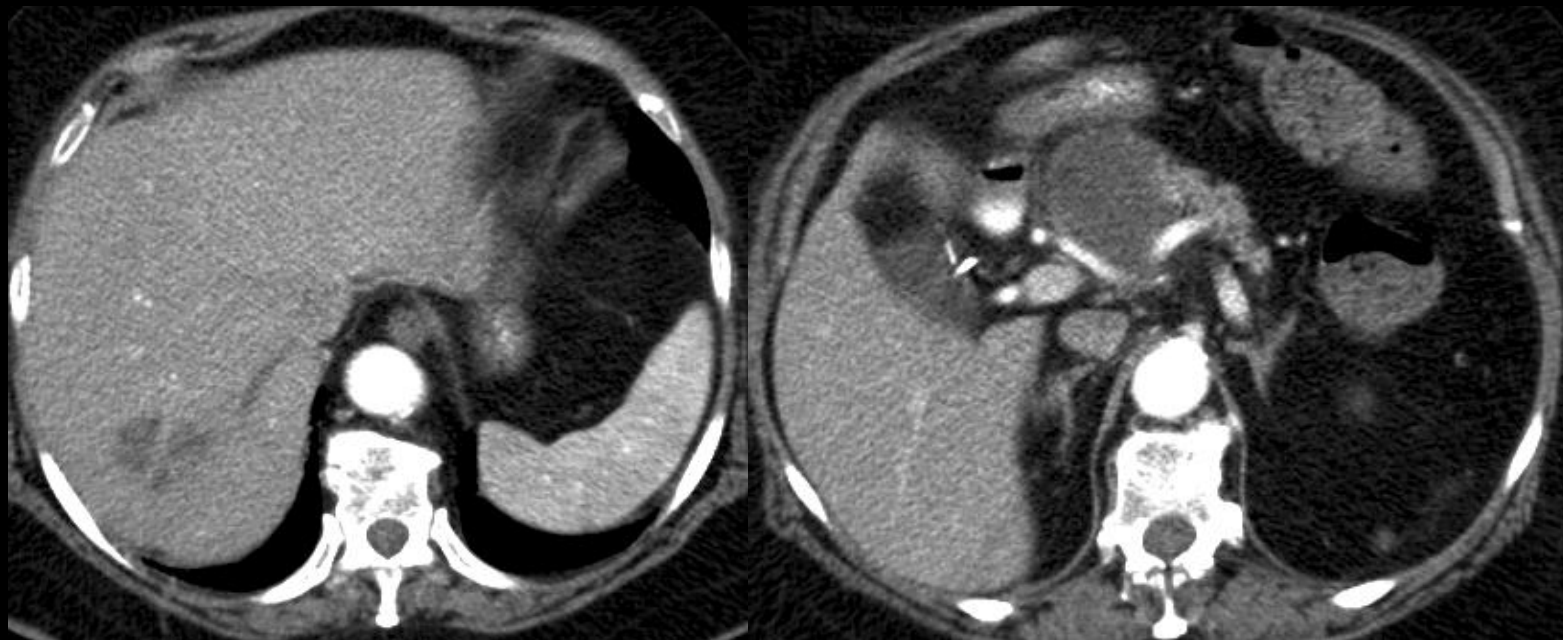
Haigusjuht 74 a. naine

- EMO- vasaku kehapoole nõrkus
- KT -> kasvaja



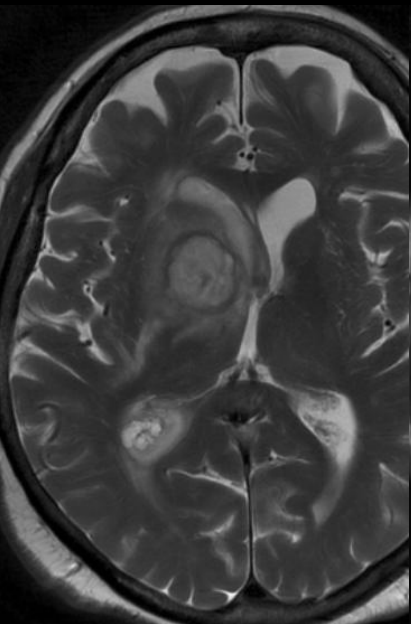
Haigusjuht 74 a. naine.

- Anamneesist - pankrease abstsess
- Kliinik - uimane, kõhuvalu
- CRP 305
- KT kõhust - maksa abstsess

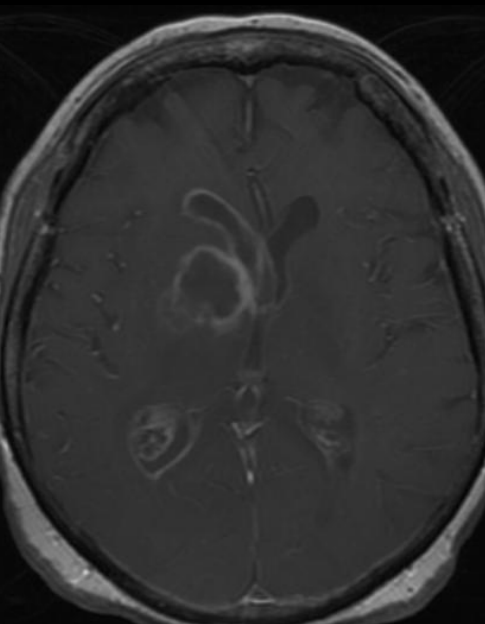


Haigusjuht 74 a. naine

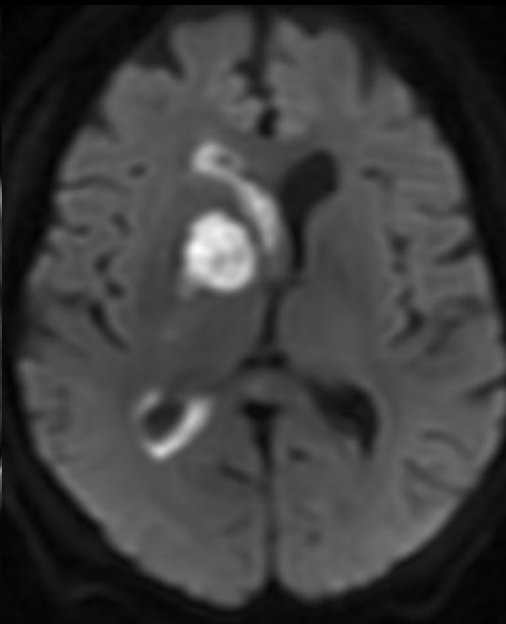
Lisandunud ventrikuliit - prognoos halb



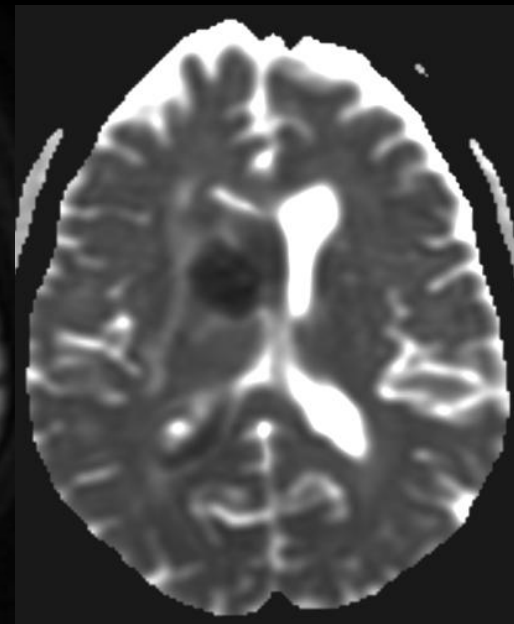
T2



T1 Gd

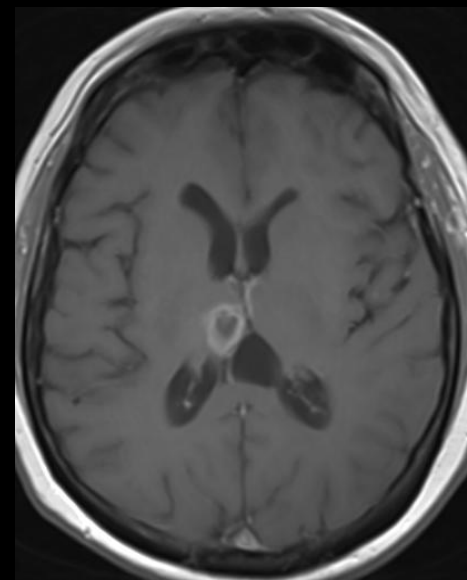


DWI

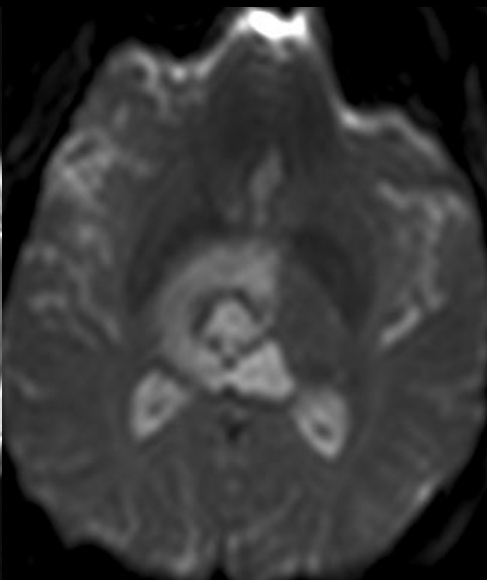


ADC

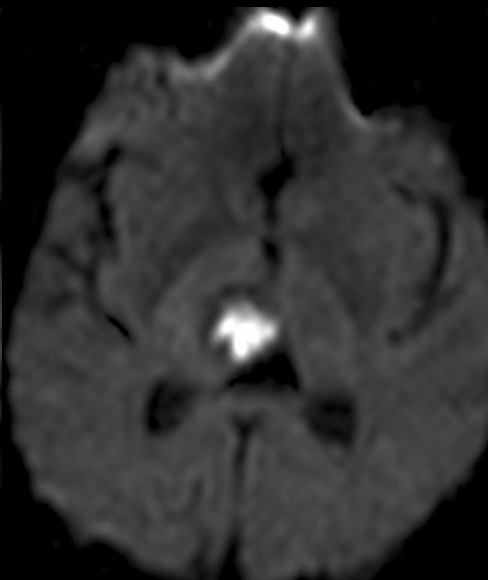
Abstsess? Tumor?



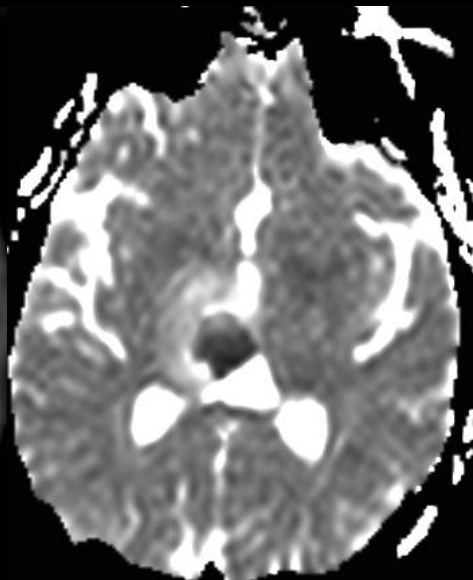
T1Gd



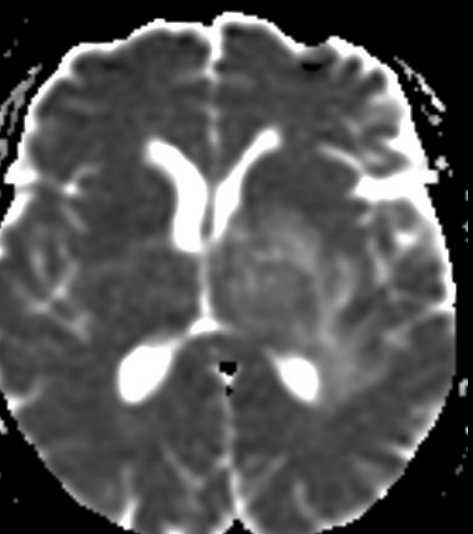
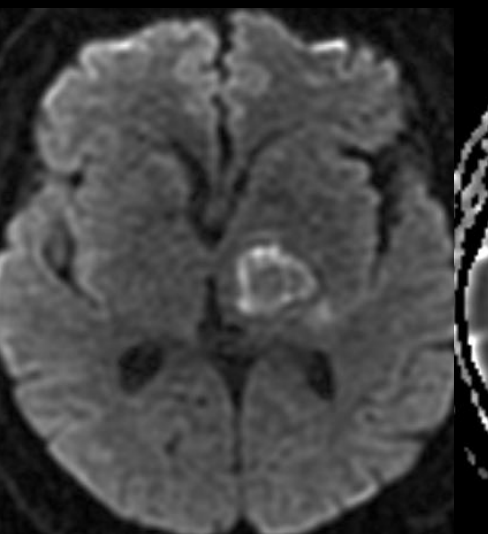
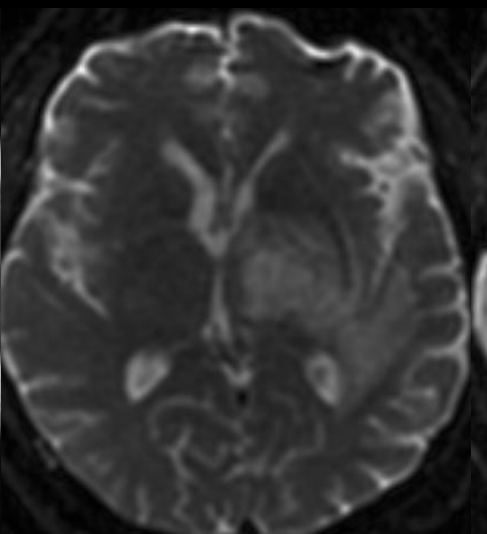
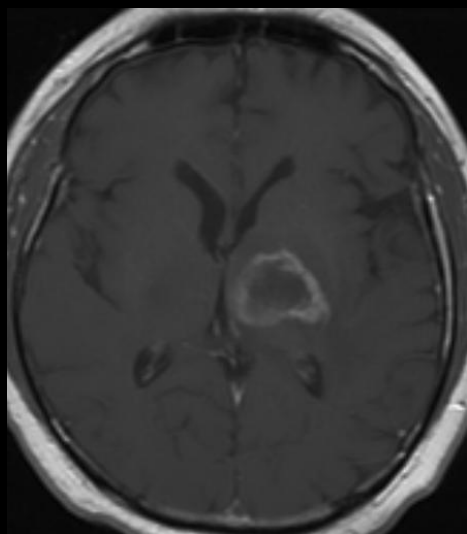
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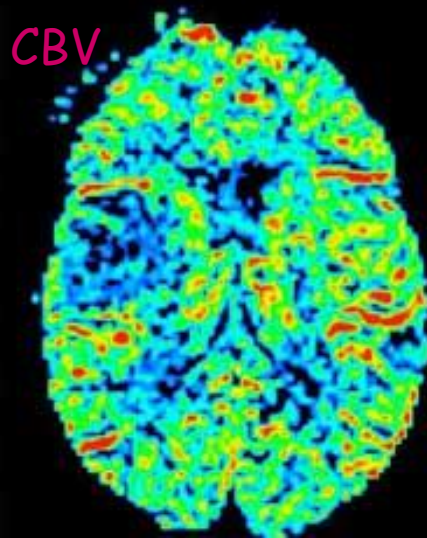
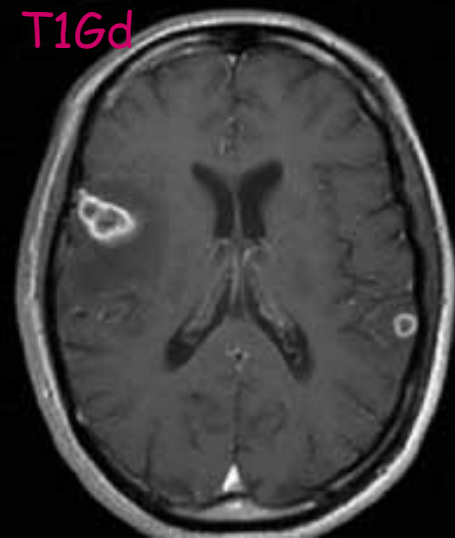
DWI b=1000



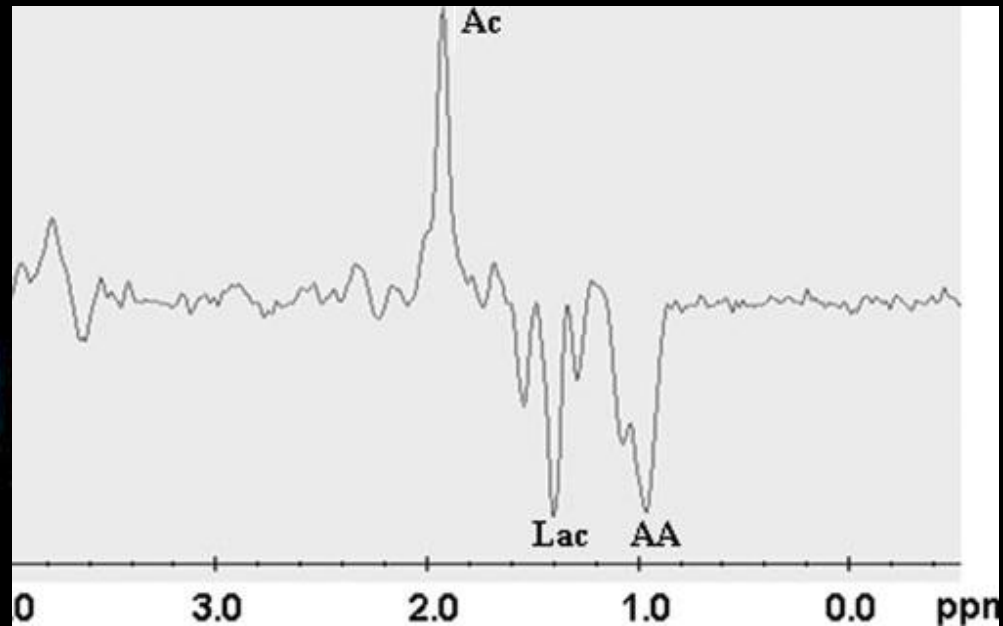
ADC



Perfusioon ja MRS



Perfusiooninäitajad vähenevad kolde piirkonnas



NAA väheneb; Lactate,alaniin, atsetaat, amonihapped kõrgemad

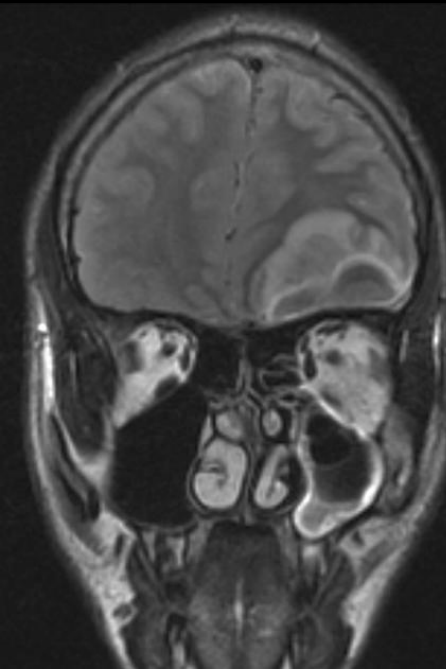
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Empüeem

- Harva
- Mädaakogumik sub-, või epiduraalsel
- Sinusiit, mastoidiit, kraniotoomia- või traumajärgne
- Harva peale meningiiti või hematogeenselt mujalt organismist
- Imikutel mädase meningiidi tüsistusena

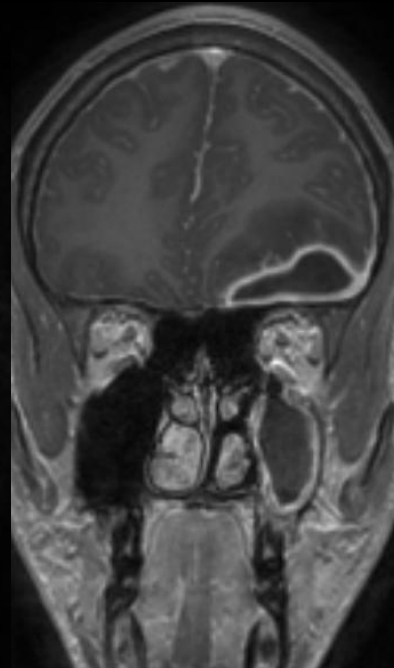
Empüüem sinusogeenne



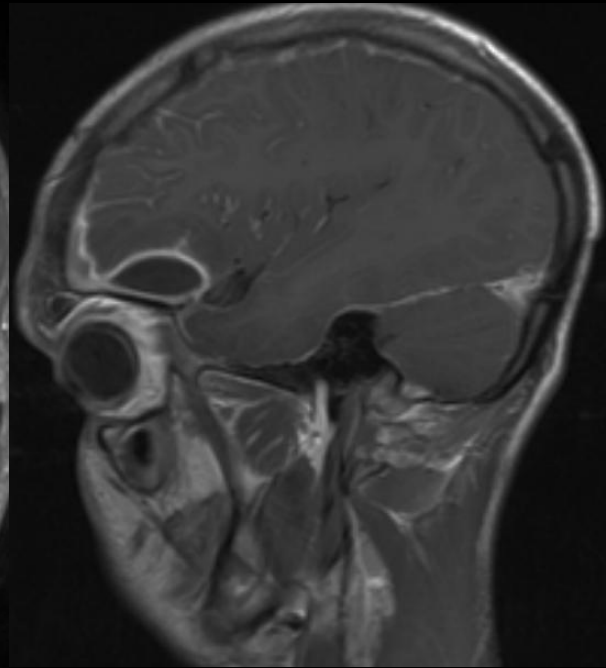
T2



T1Gd



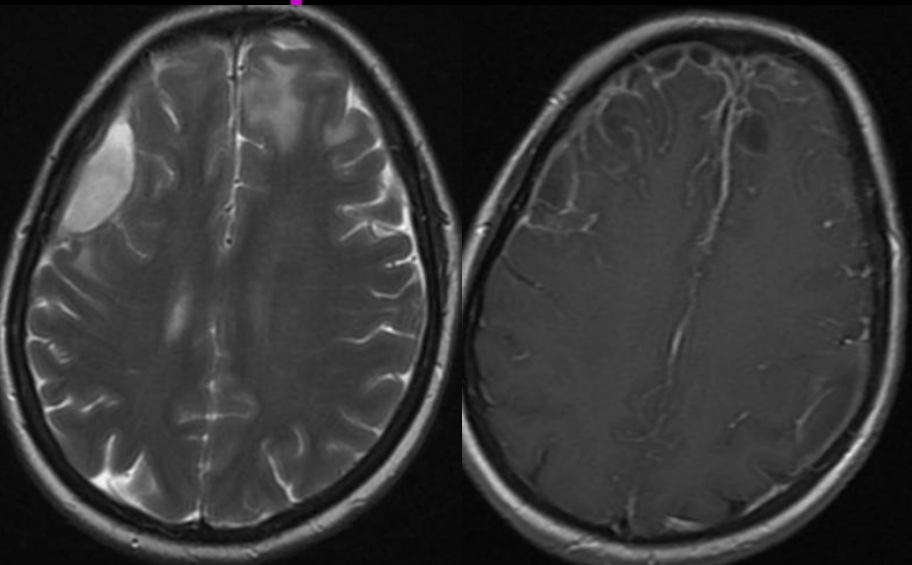
T1Gd



T1Gd

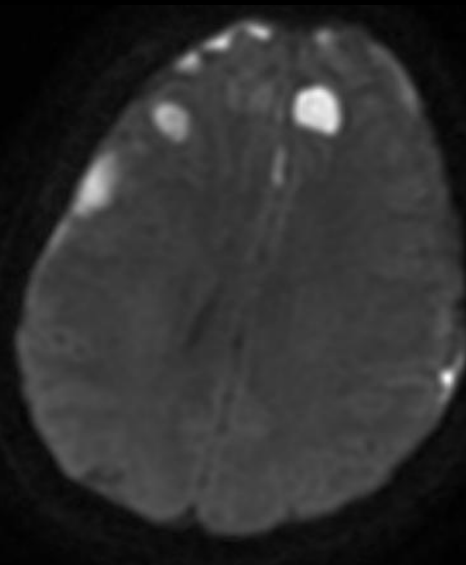
Krooniline sinusiit -> mädane meningiit -> subduraalne abstsess

Empüemid / abstsessid

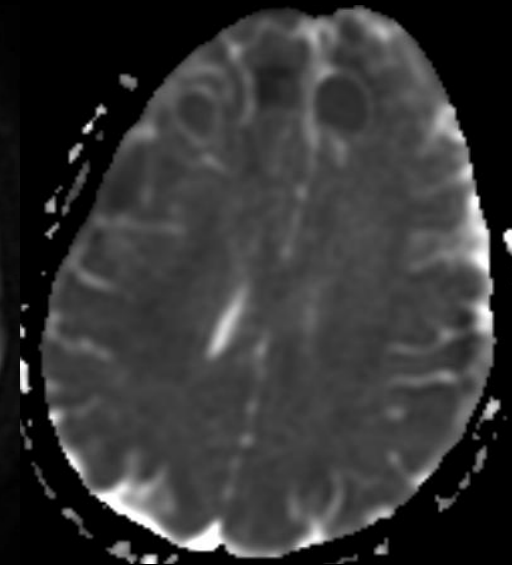


T2

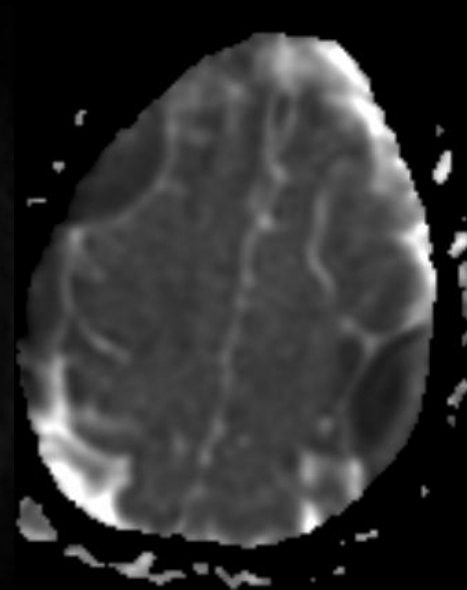
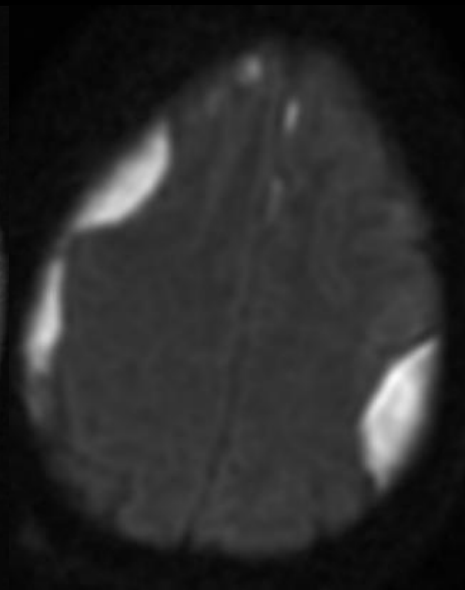
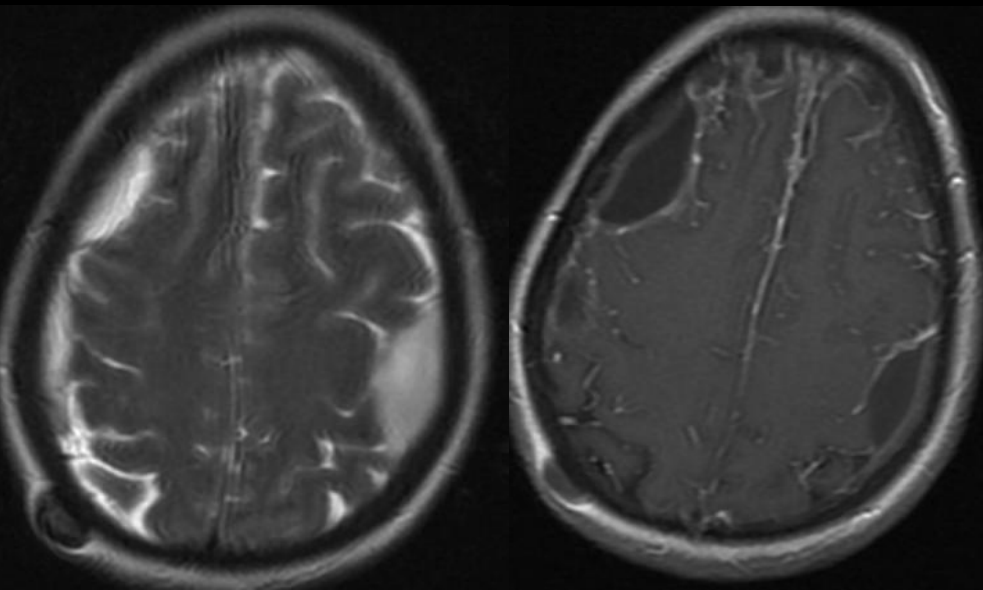
T1 Gd



DWI



ADC



Neuroinfektsioonid

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- Abscess
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- *Entsefaliit*
- Tsüstjad lesioonid
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Entsefaliit

- Difuusne ajukoe põletik
- Nakatumine hematogeenselt või perifeersete närvide kaudu
- Viirused:
 - Herpes Simplex Virus 1 ja 2
 - Herpes zoster
 - Arbo- ja enteroviirused, Lääne Niiluse viirus, Nipah viirus jne.
- Radioloogiline leid sarnane

Entsefaliit

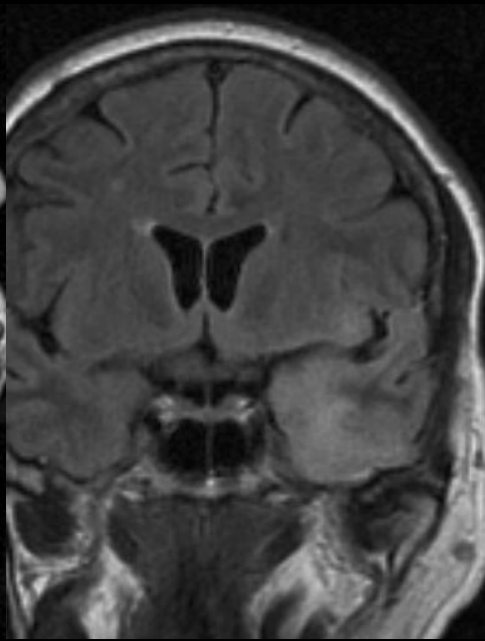
- Äge haigus
 - Krambid, teadvushäire, deliirium, afaasia, ataksia
 - Hallutsinatsioonid, isiksuse muutus
- Kiire diagnoos ja ravi
- PCR meetodil viiruse DNA liikvorist

Herpes entsefaliit

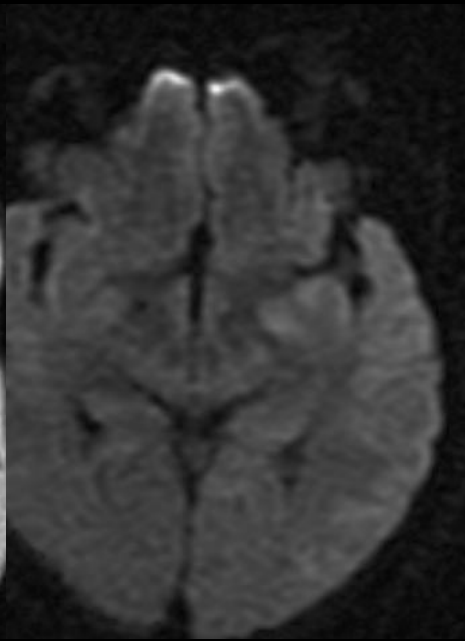
- Levik ajusse *ganglion trigeminale* kaudu
- Nekrotiseeriv põletik mediobasaalsel temporaalsagarates
- Basaaltuumi ei haara
- Turse, hemorraagiad
- Algab ühepoolsest, levib bilateraalsele



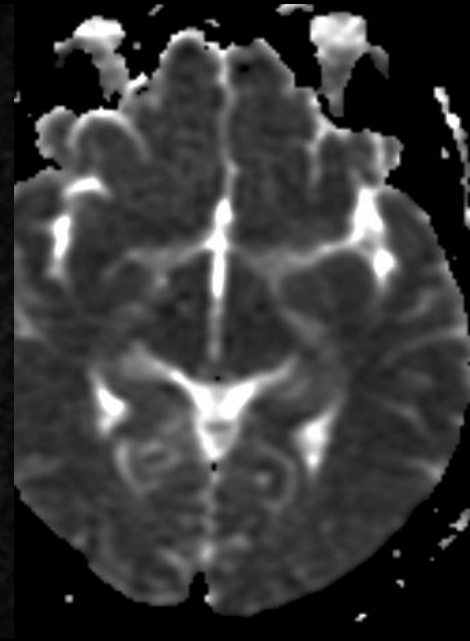
T2



FLAIR



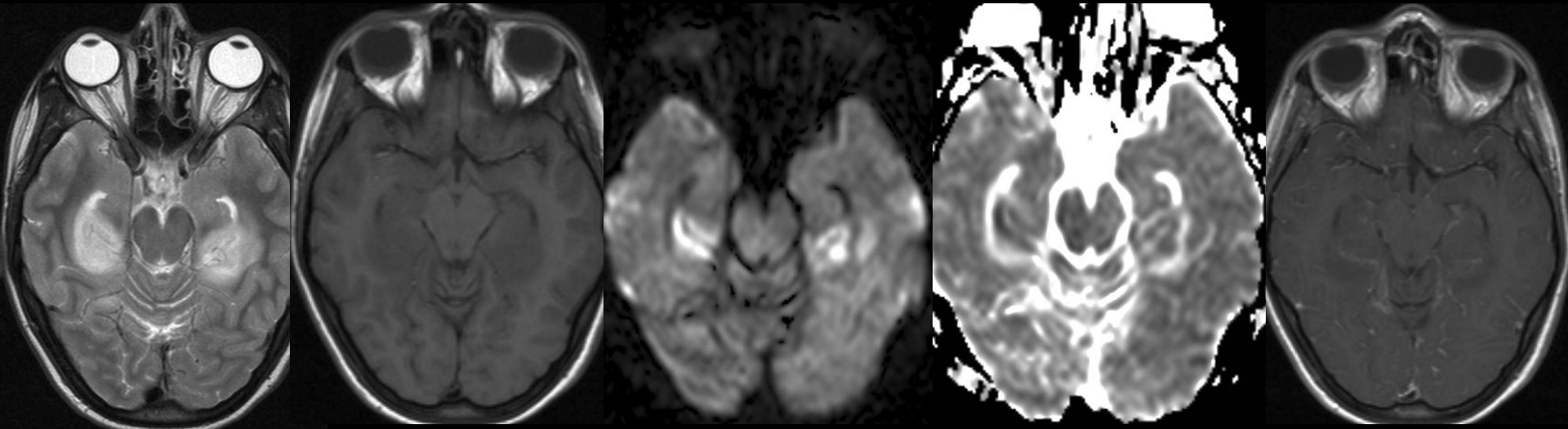
DWI



ADC

Herpes entsefaliit

- MRT valikmeetod, KT patoloogiata alguses
- DDX - neurosüüfilis



T2

T1

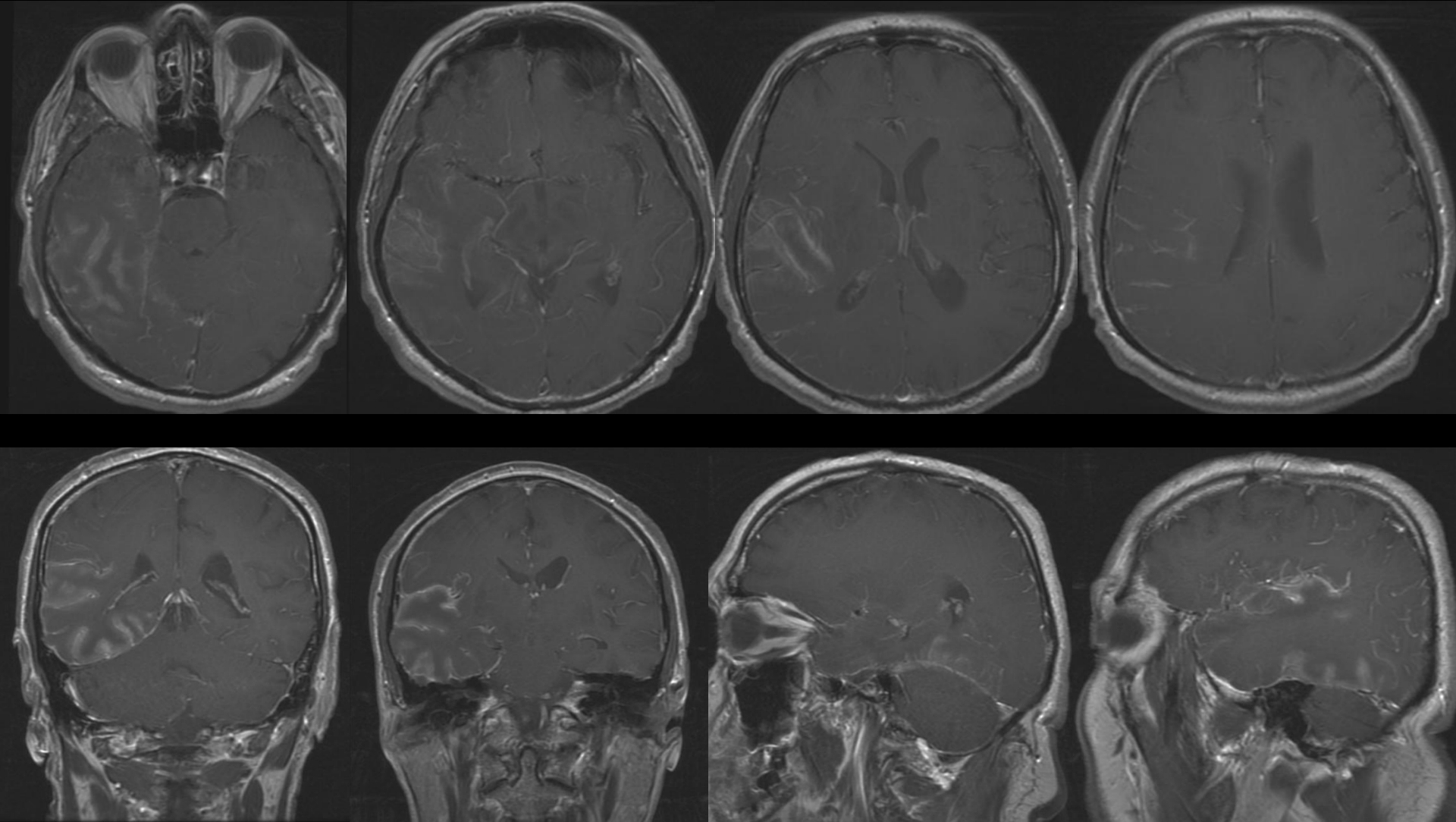
DWI

ADC

T1Gd

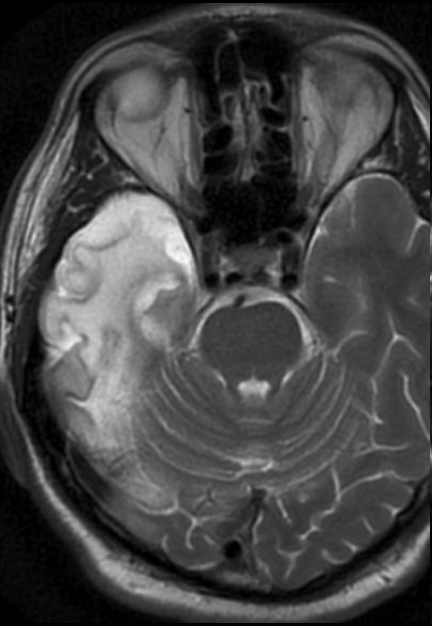
Herpes entsefaliit

- KA-ga difuusne, triipjas ja/või kortikaalne-meningeaalne kontrasteerumine

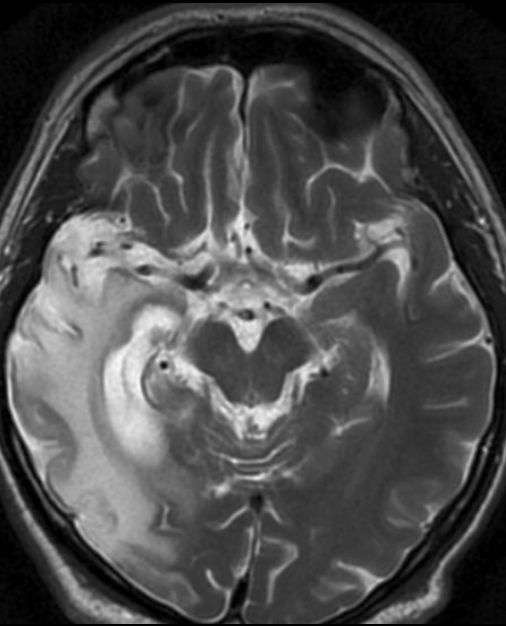


Herpes entsefaliit

- Paranede vältendunud T-sagarate atroofia



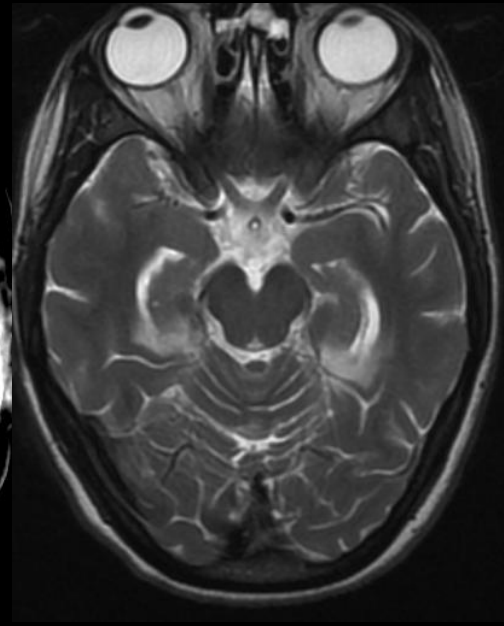
T2



T2



KT

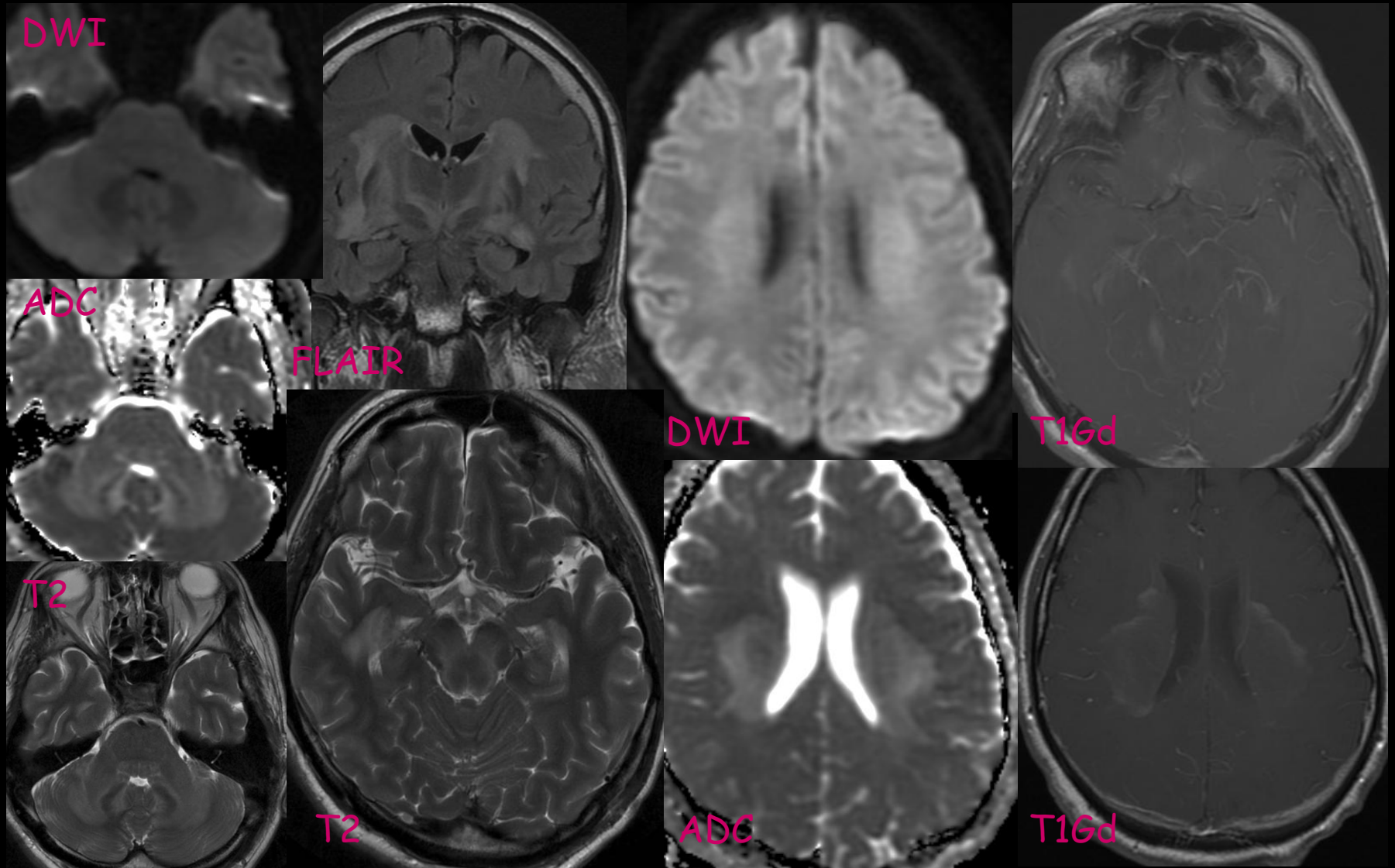


T2

Teised entsefaliidid

- Tekitaja viirus
- T2 signaali muutus
 - HA+- ja VA
 - Basaaltuumad
- Pilvjad kolded, veri
- Zoster
 - Ajutüvi, korteks
- Enteroviirus
 - Piklikaju tagumine osa, ajutüvi, keskaju, *nucleus dentatus*
- Jaapani entsefaliit
 - VA, ajutüvi, basaaltuumad, taalamused

Entsefaliit, enteroviirus ?

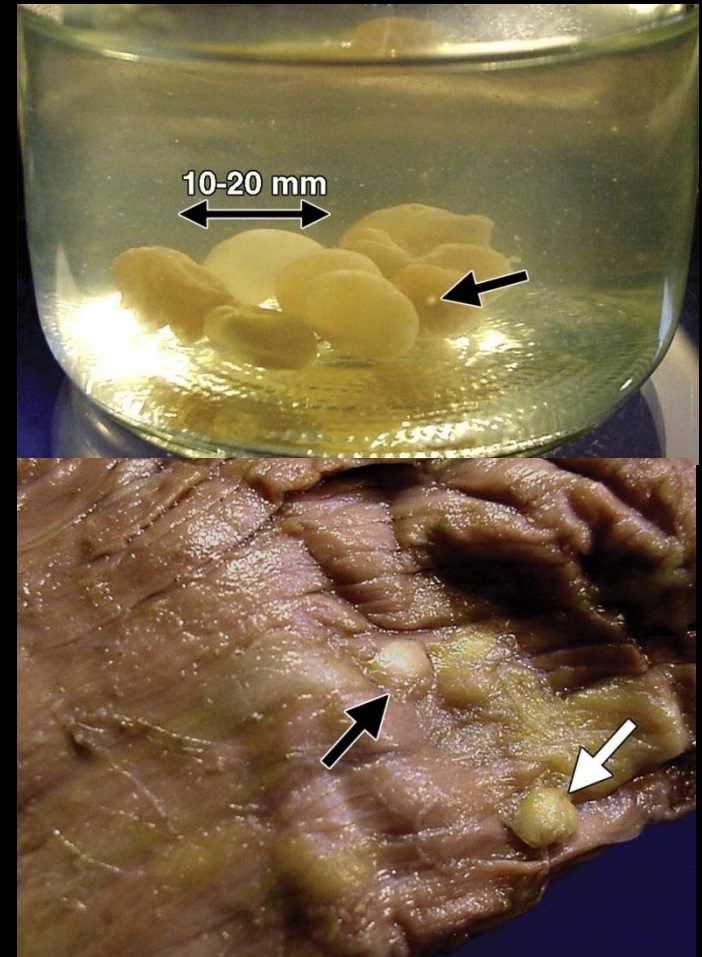


Neuroinfektsioonid

- Absstsess
- Meningiit
- Ajuväliste ruumide põletik
- Entsefaliit
- *Tsüstjad lesioonid*
- AIDS-iga seotud infektsioonid
- Neuroborrellioos, Lyme tõbi

Tsüstid - neurotsüstitserkoos

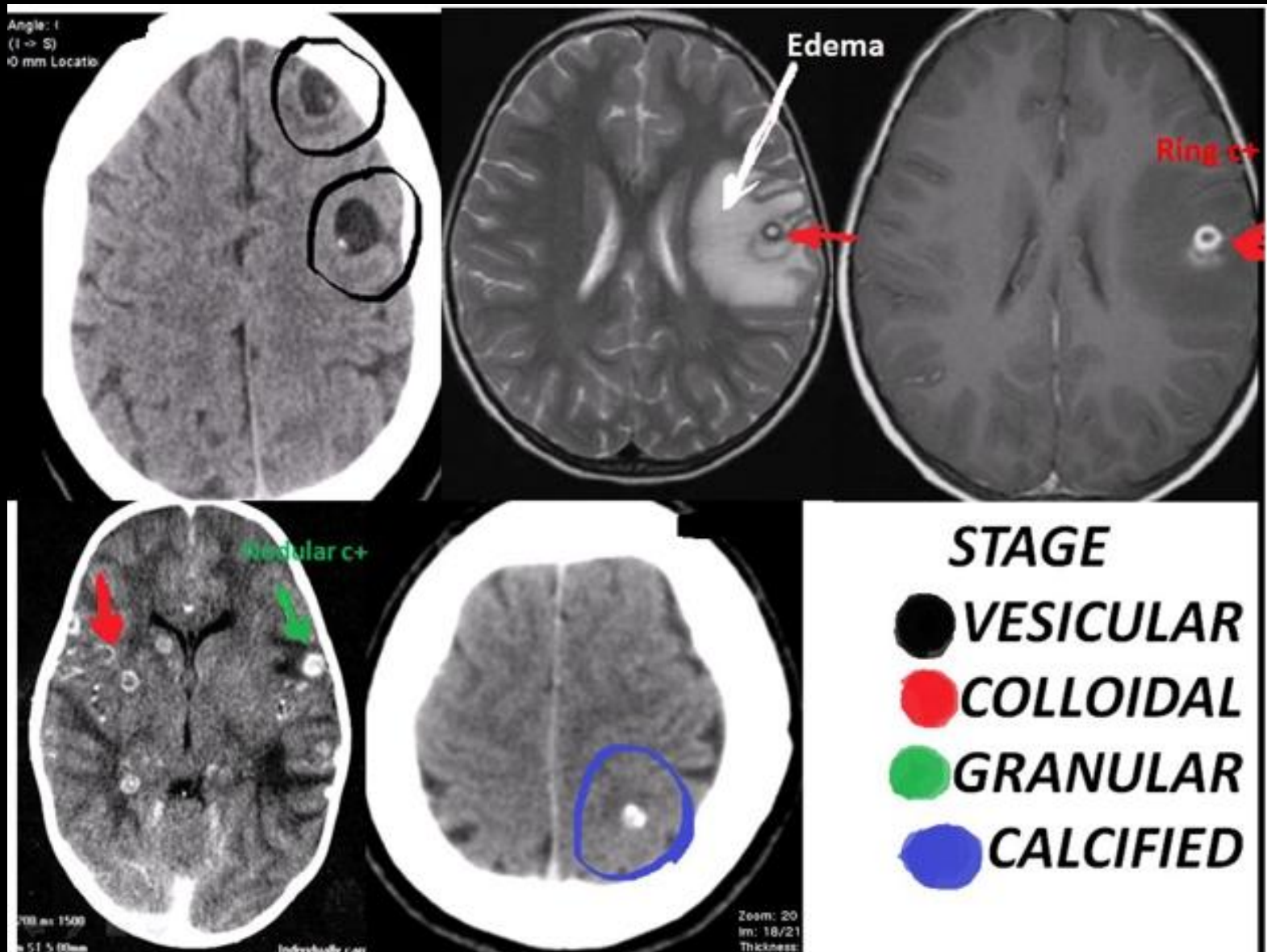
- Ainult endeemilises piirkonnas viibinutel
- Munadega nakatunud sealiha söömisel - fekaal-oraalne tee
- Uss *Taenia solium*'i larva
- Levib hematogeenselt kogu organismis
- KNS - kliinik -> lokalisatsioon
 - Aju parenhüüm
 - Subarahnoidaalruum
 - Vatsakeste süsteem
 - Seljaaju



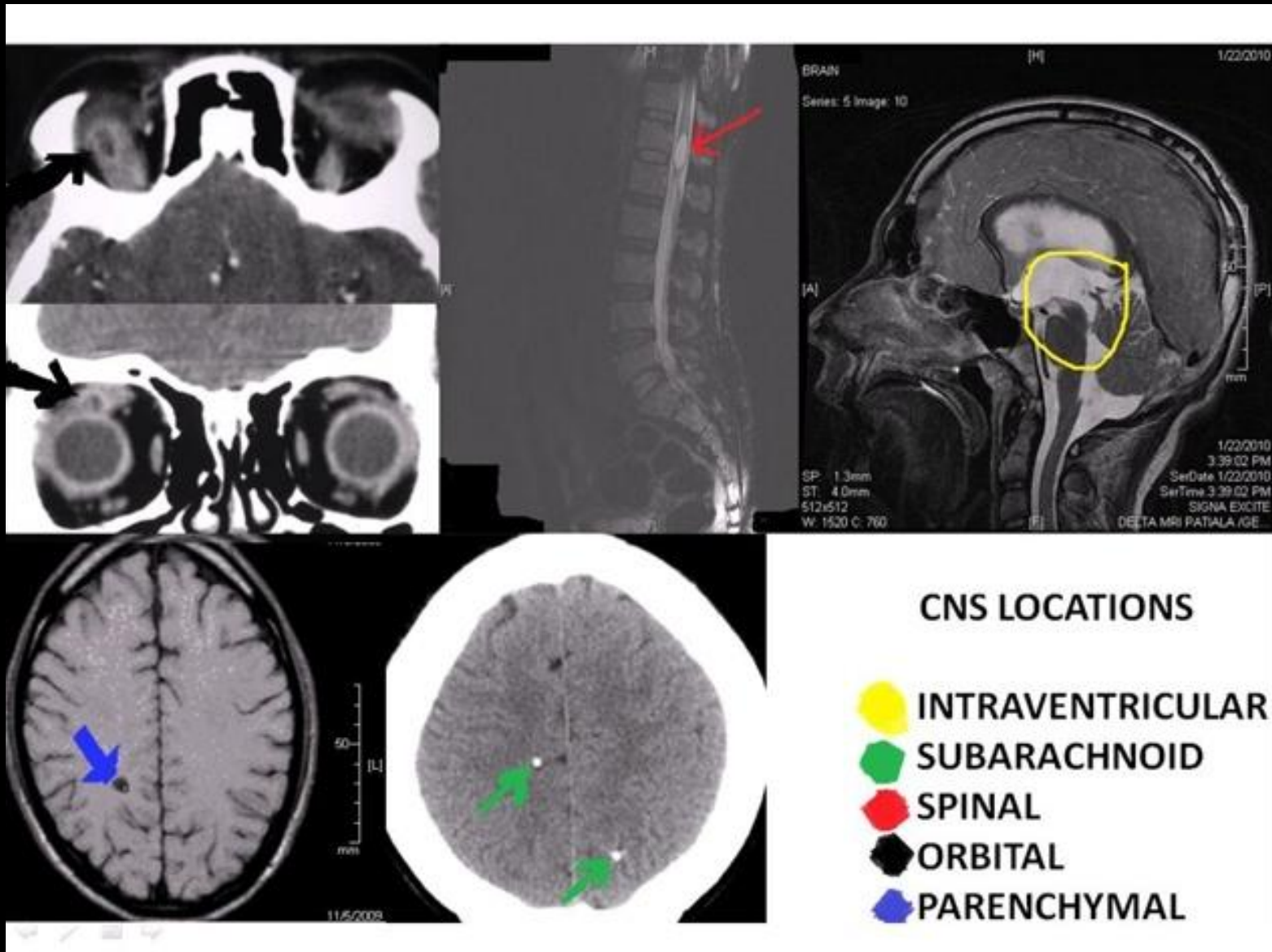
Neurotsüstitserkoos - radioloogiline leid

- Tsüstilised kolded aju parenhüümis, mille sees *scolex*
- Lokaalne mass-efekt
- Perifeerne, tsüstjas kontrasteerumine
- Tsüsti arenedes kontrasteerumine kaob, sein kaltsifitseerub - KT
- Võib põhjustada HC - 20% vatsakeste sees
- DDX: kaltsifikaate põhjustavad haigused
 - infektsioonid, tuumorid

Staadiumid



Lokalisatsioon



Neuroinfektsioonid

- Meningiit
- Abscess
- Ajuväliste ruumide põletik
- Entsefaliit
- Tsüstjad lesioonid
- *AIDS-iga seotud infektsioonid*
- Neuroborrellioos, Lyme tõbi

AIDS-iga seotud infektsioonid

- Peamine KNS infektsioonide põhjus
- 10% haigetel esmased KNS sümptomid
- 75-95% haigetest lahingul KNS haaratus

HIV/AIDS „esimeses maailmas“

- HAART - *highly active antiretroviral treatment*
- Elulemus 10.5 → 22.5 10 aastaga
- Surmaotus → krooniline haigus

HIV/AIDS „teises maailmas“

- Antiretroviirusravi ei ole
- Haigus teistsugune
- Äge > krooniline
 - Ei ela piisavalt kaua, et saada tüsistusi
 - HIVE, crypto, PML
 - Kaasnevad infektsioonid ↑↑ - TBC
 - Kiire kuluga põletikud aju abstsessid

KNS haaraus

- Ajus:
 - HIV entsefaliit - HIVE
 - "Oportunistlikud" infektsioonid
 - *Immune reconstitution inflammatory syndrome* - IRIS
 - Aju lümfoom

HIV ENTSEFALIIT

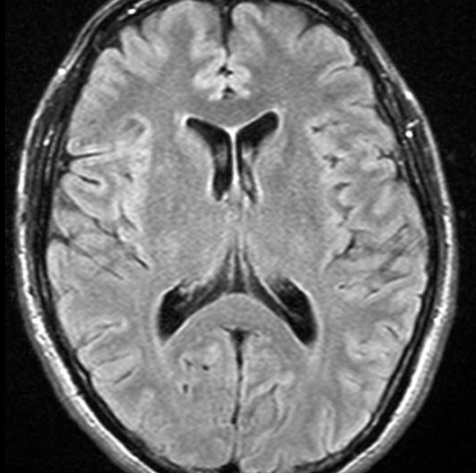
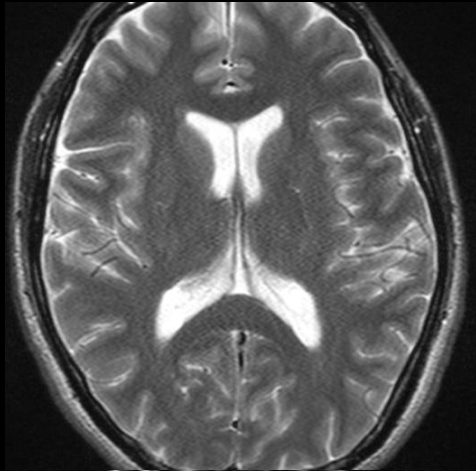
- Sagedasim infektsioon
 - Progresseeruv dementsus
- Ajus tekib
 - Difuusne atroofia
 - Demüelinisatsioon
 - Difuusne/koldeline
 - Bilateraalne/asümmeetriline
 - Ei kontrasteeru
 - MRS ↑ Cho



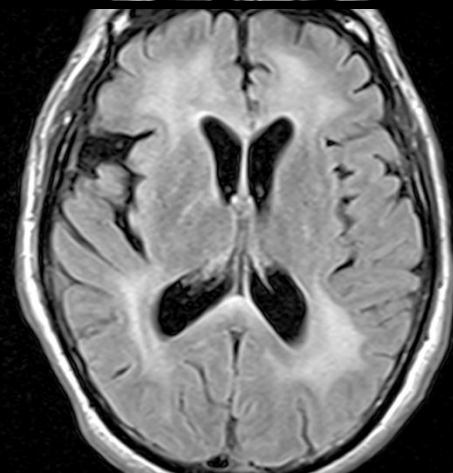
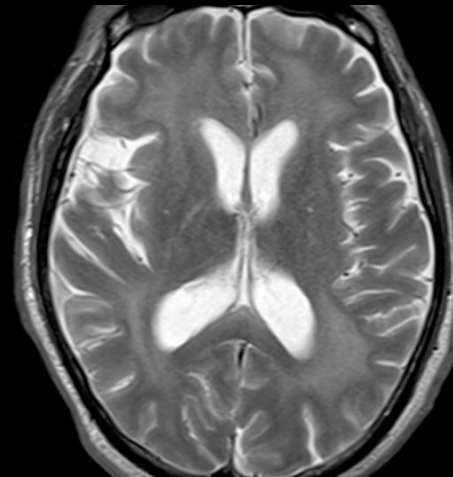
HIV ENTSEFALIIT:

45 a. HIV+ Dementne mees pikaajaliselt HAART

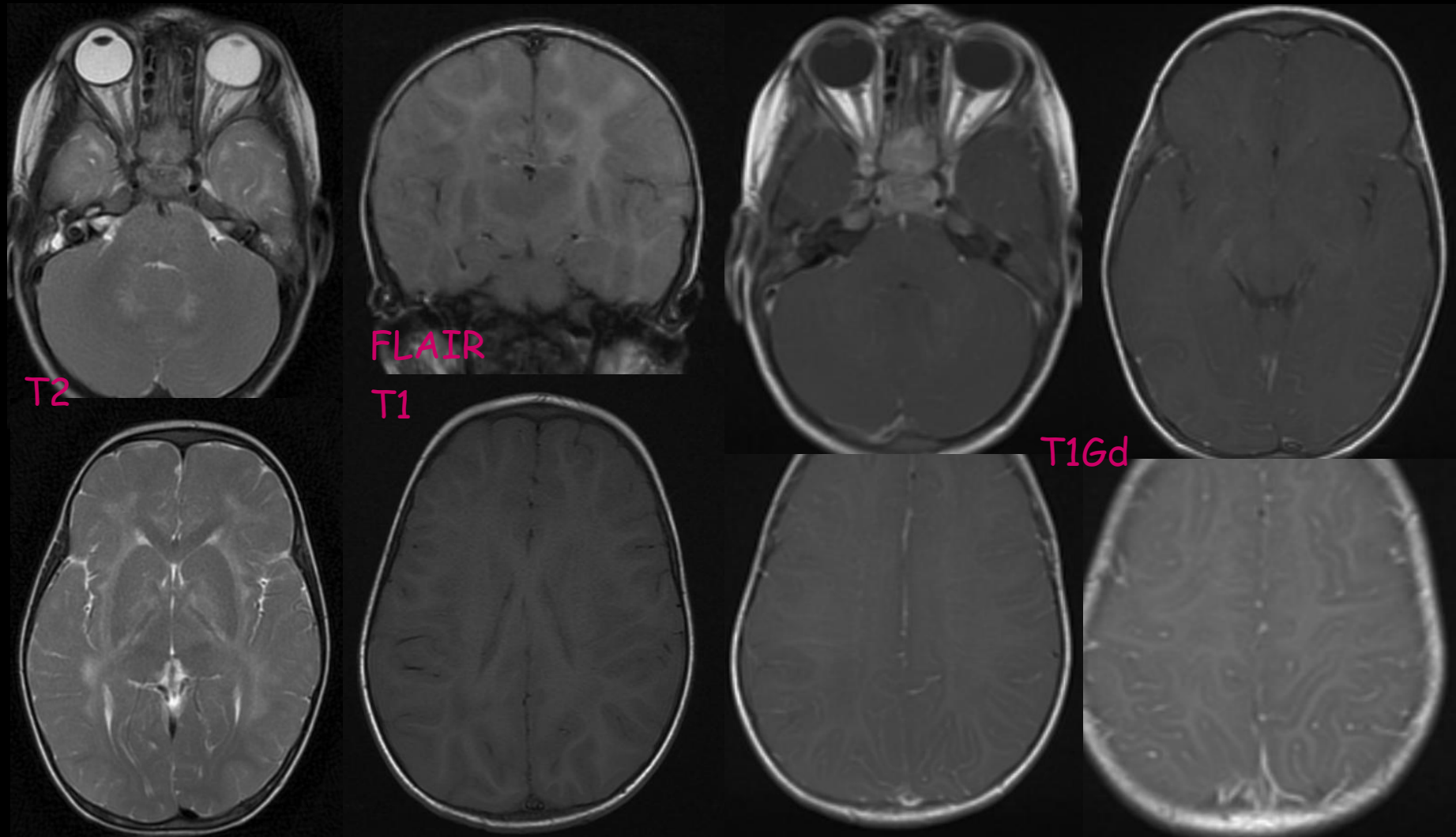
2005



2009



HIVE 3. a. Kaasasündinud HIV



KNS INFEKTSIOONID AIDS

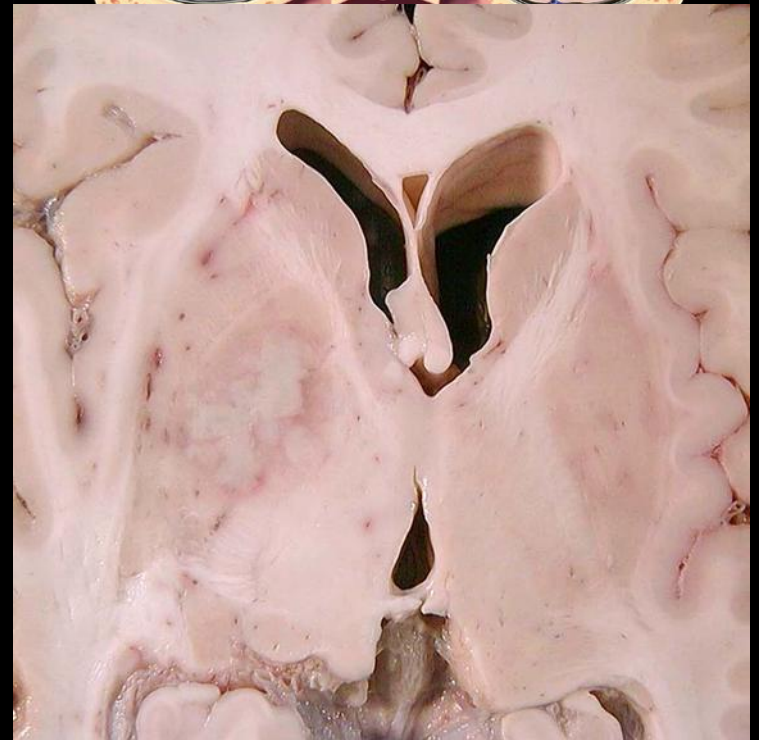
- Pikaajalist ravi saavad patsiendid
 - *Toxoplasmosis* (parasiit)
 - Entsefaliit, abstsessid
 - *Cryptococcosis* (seen)
 - Granulomatoosne meningiit, paremhüümi kolded
 - PML (viirus)
 - Subakuutne demüelinisatsioon
 - **Teised infektsioonid**
 - Tuberkuloos (TBC)
 - Meningiit, tuberkuloomid, abstsessid
 - Süüfilis
 - CMV
 - Entsefaliit, ventrikuloentsefaliit
 - Teised viirused (VZV, hepatiit C)
 - Bakterid (harva)

CD4+ T lümfotsüüdid & KNS haigus

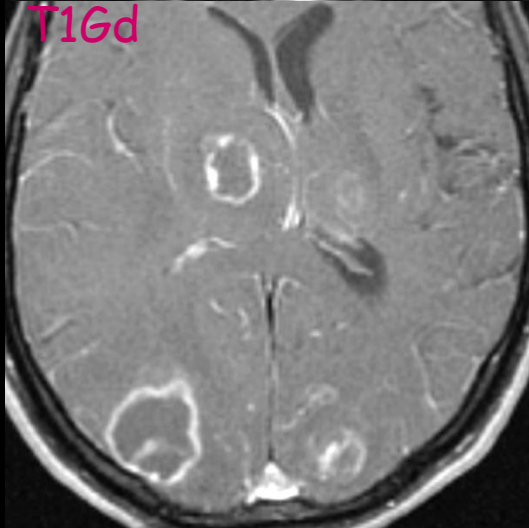
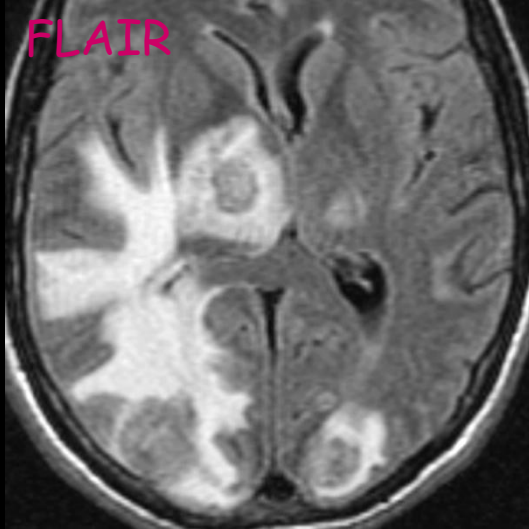
	>500	500-200	< 200	< 100
Süfiliitiline meningiit	X	X	X	X
TBC		X	X	X
AIDS dementsus			X	X
Krüptokokk meningiit			X	X
Toksoplasmoos			X	X
Kokkoidal meningiit			X	X
PML				X
Primaarne KNS lümfoom				X
CMV entsefaliit				X

TOKSOPLASMOOS

- Nr. 1 infektsioon
- 20%-40% HIV+
- Lokalisatsioon
 - Basaaltuumad
 - HA-VA piir
- Mitmed >> üksikud
- Tavaliselt ringjas kontrasteerumine
 - +/- "Target" sign
- DDX: lümfoom



TOKSOPLASMOOS

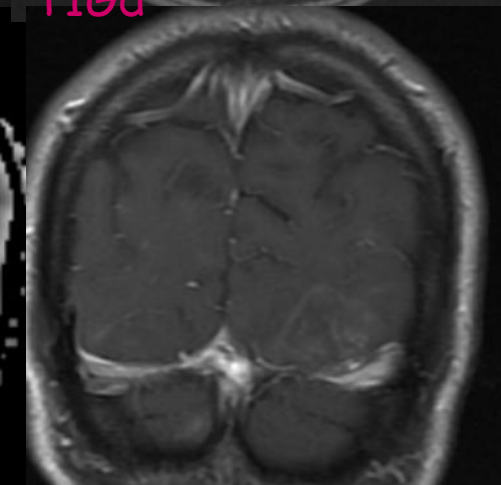
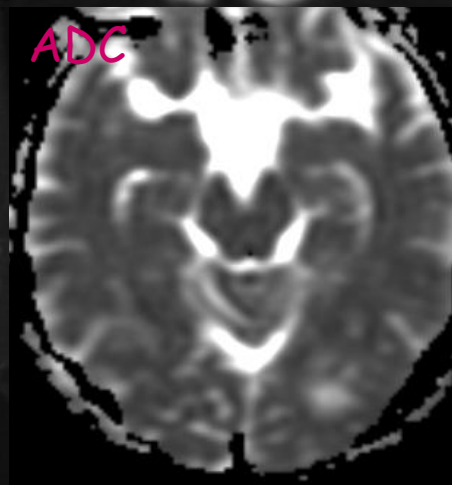
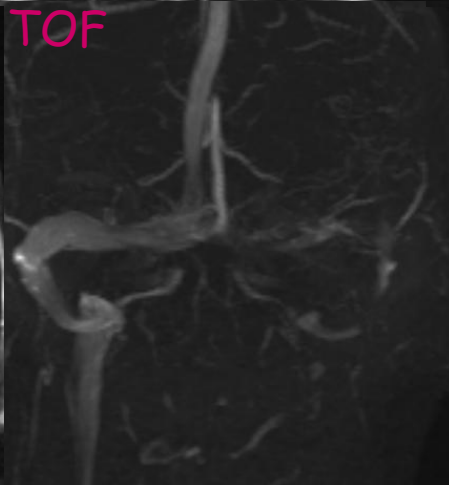
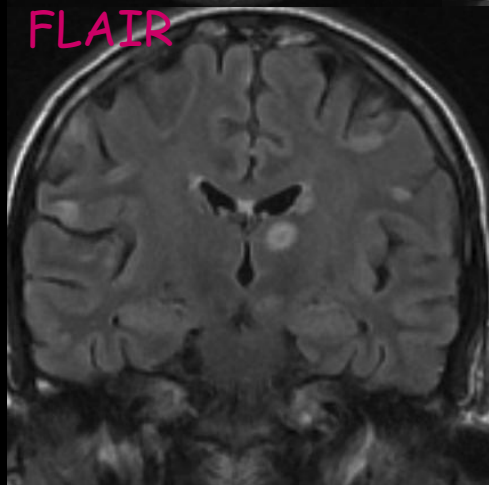
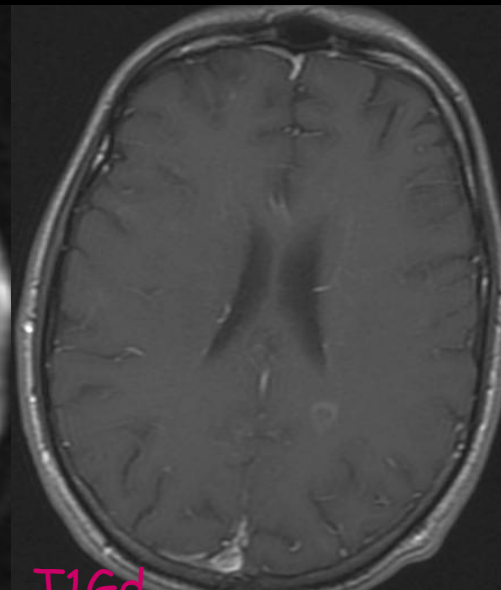
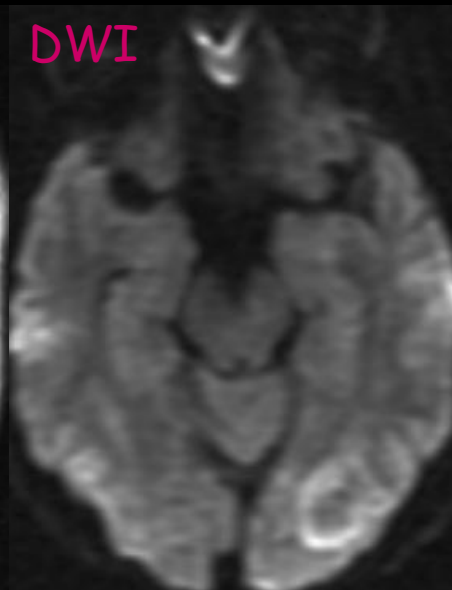
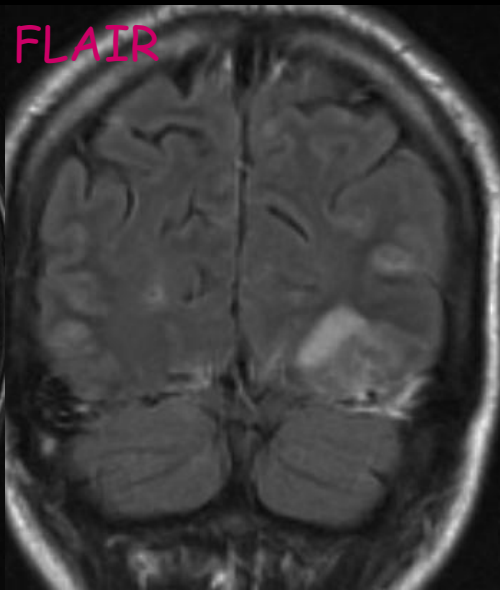
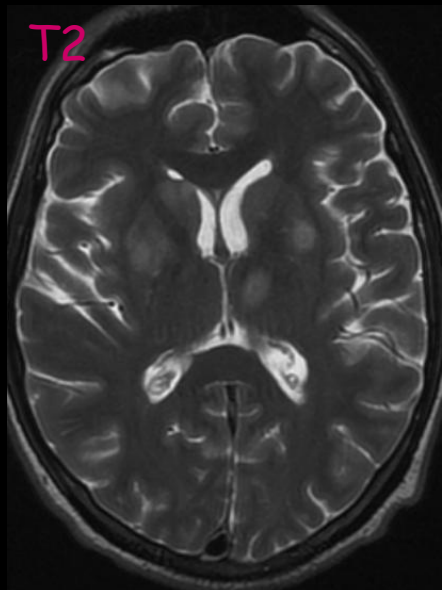


- T2 hüpo/iso
- Vasogeenne tursevall
- + veri
- T1Gd mitmed kontrasteeruvad ringjad kolded
- 75% taalamus
- DWI - väga mitmekesine
- Raviga väheneb kollete hulk

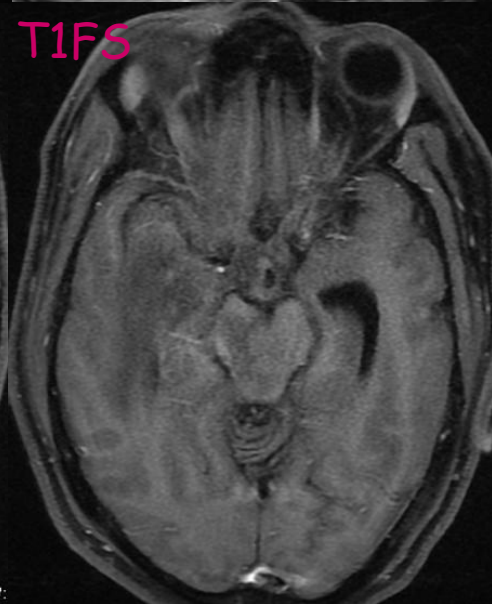
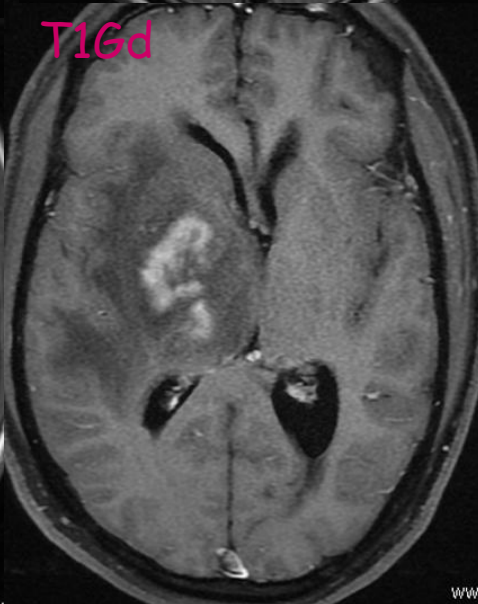
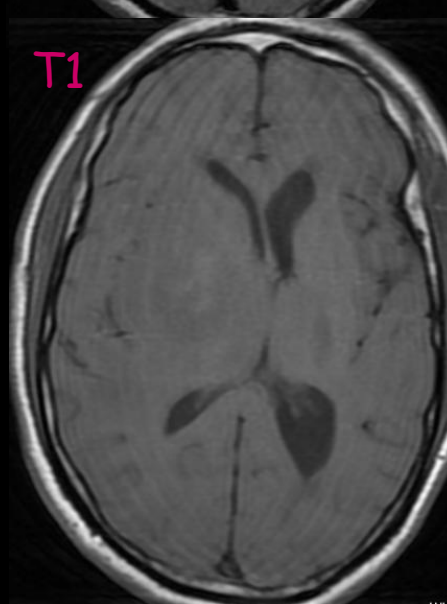
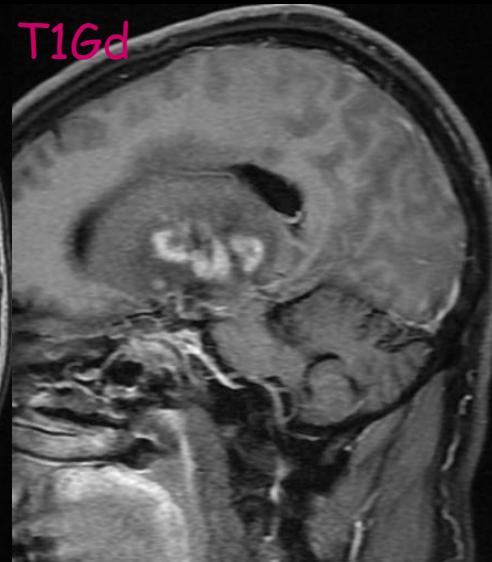
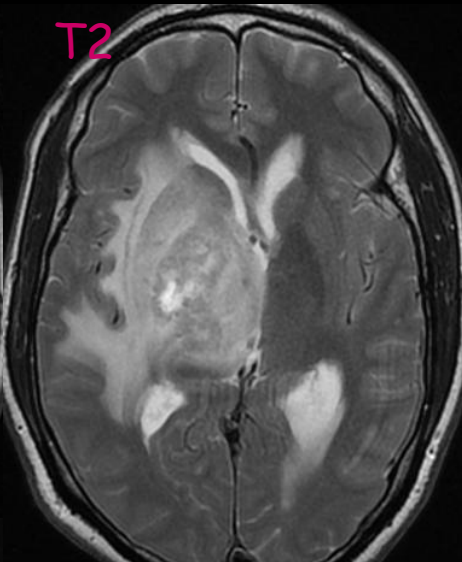
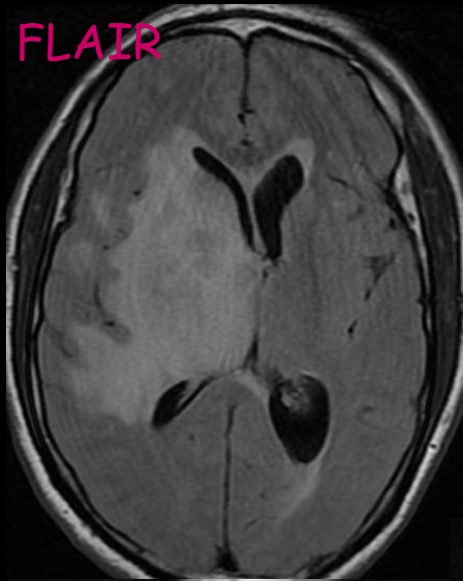


+/- "Target" sign

TOKSOPLASMOOS



TOKSOPLASMOOS



LÜMFOOM vs. TOKSOPLASMOOS

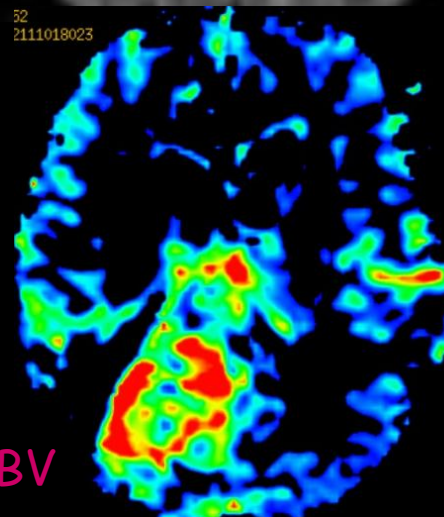
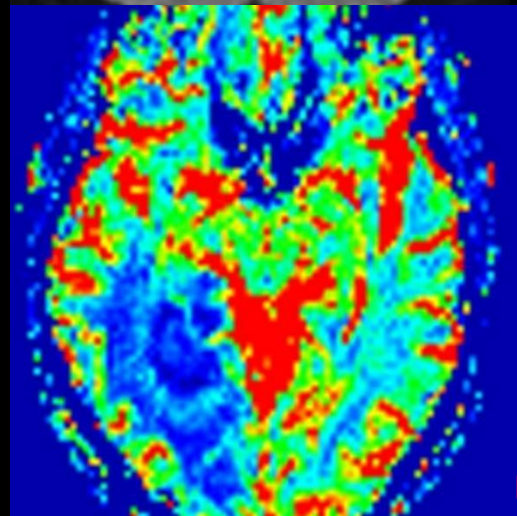
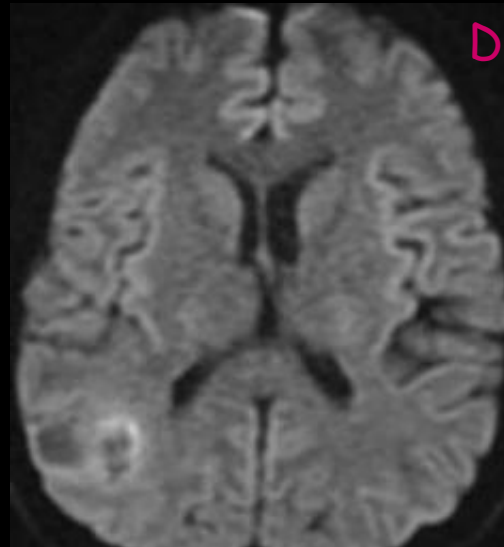
Lümfoom

- Üksik kolle
- Subependümaalne levik
- Ühtlasem kontrasteerumine
- Th SPECT pos
- MRS : Cho↑
- MR perfusioon : ↑rCBV
- DWI +++

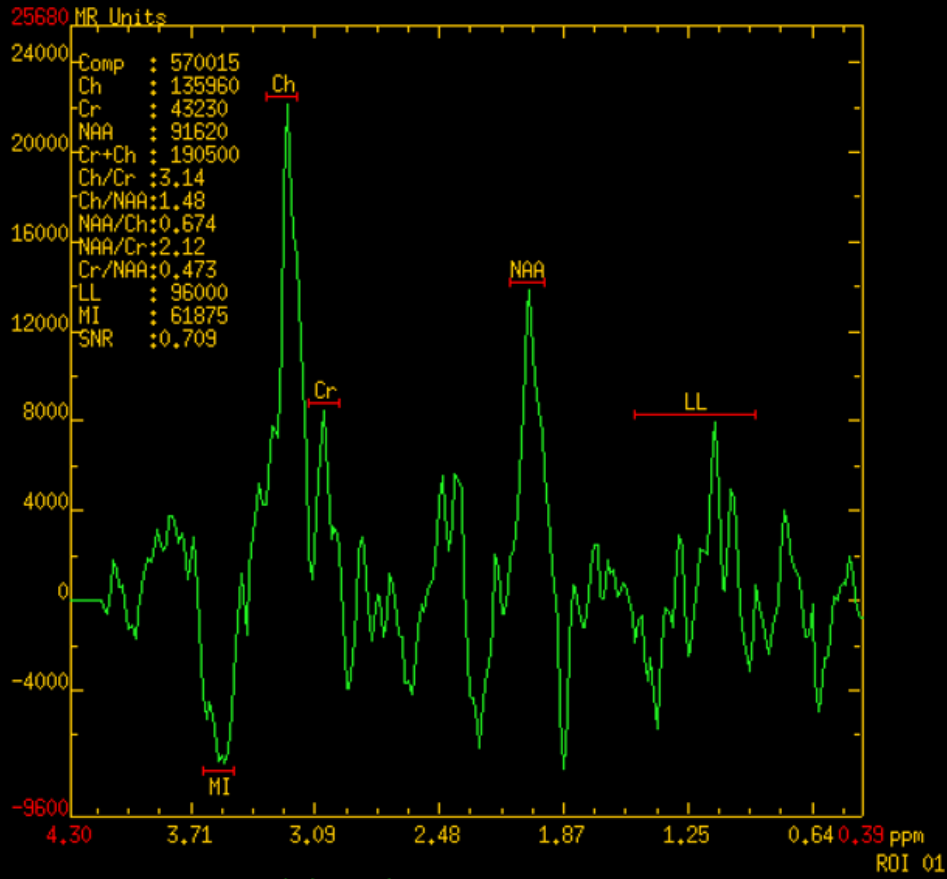
Toksoplasmoos

- Mitu kollet
- Basaalganglionides ja HA ja VA piiril
- Ringjas või nodulaarne kontrasteerumine
- Th SPECT neg
- MRS : ↓Cho
- MR perfusioon : ↓ rCBV
- DWI+-

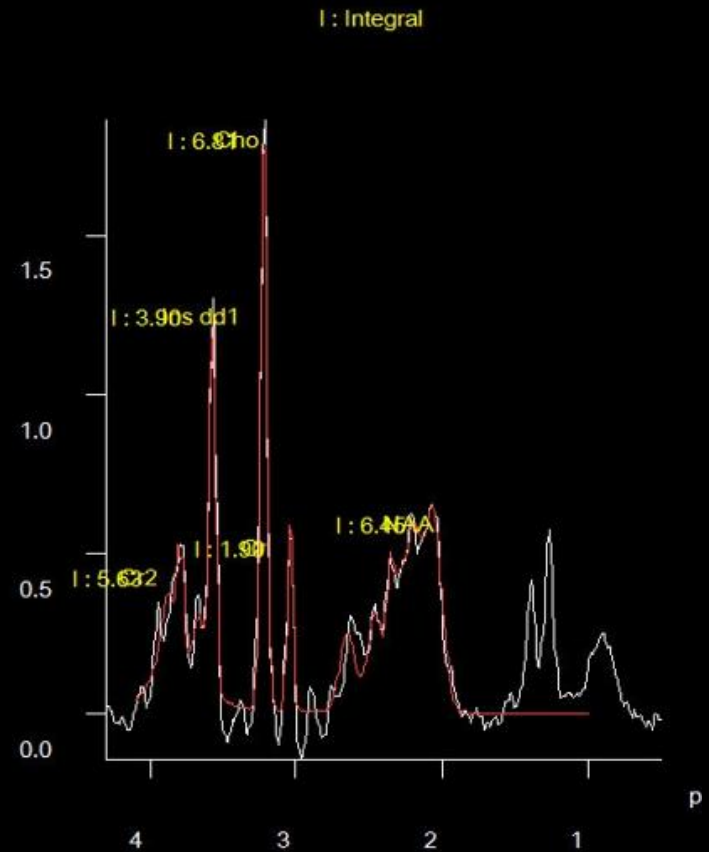
TOKSOPLASMOOS vs. LÜMFOOM



TOKSOPLASMOOS vs. LÜMFOOM MRS



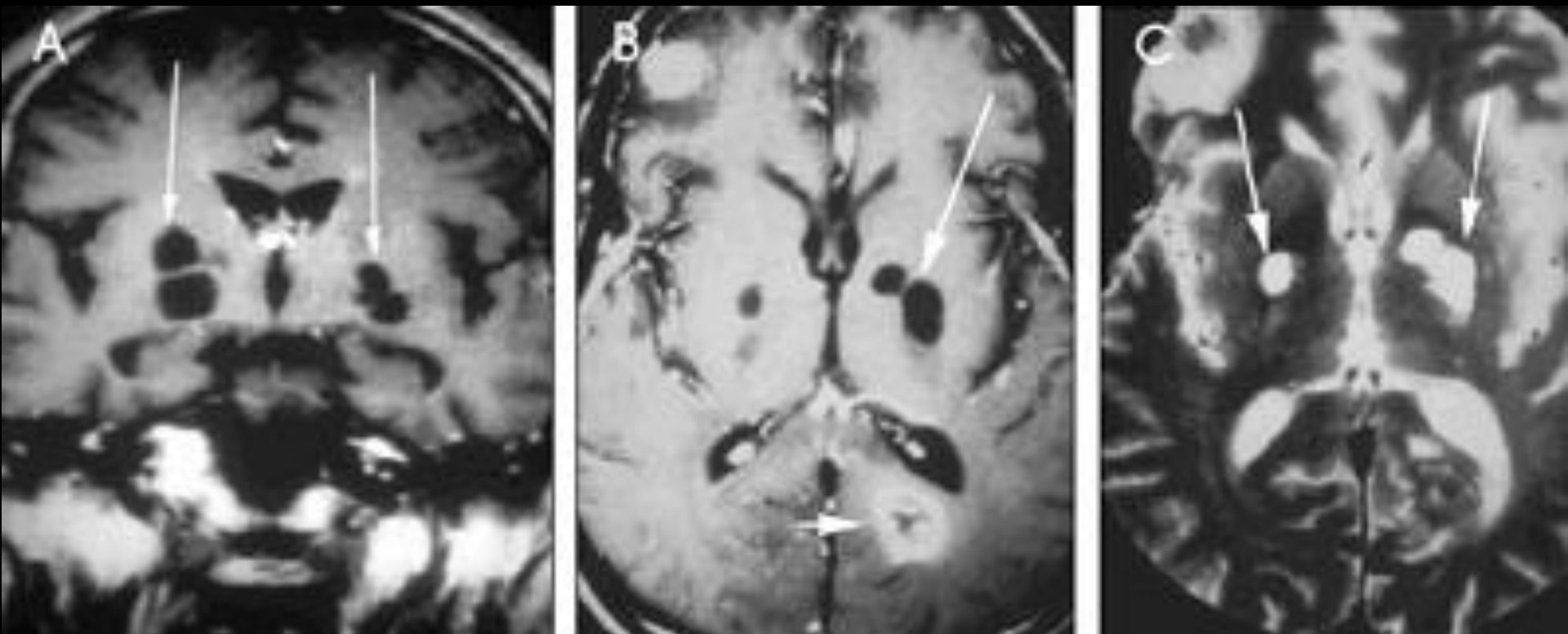
MRS : Cho ↑



MRS : Cho ↑ ↑ ↑

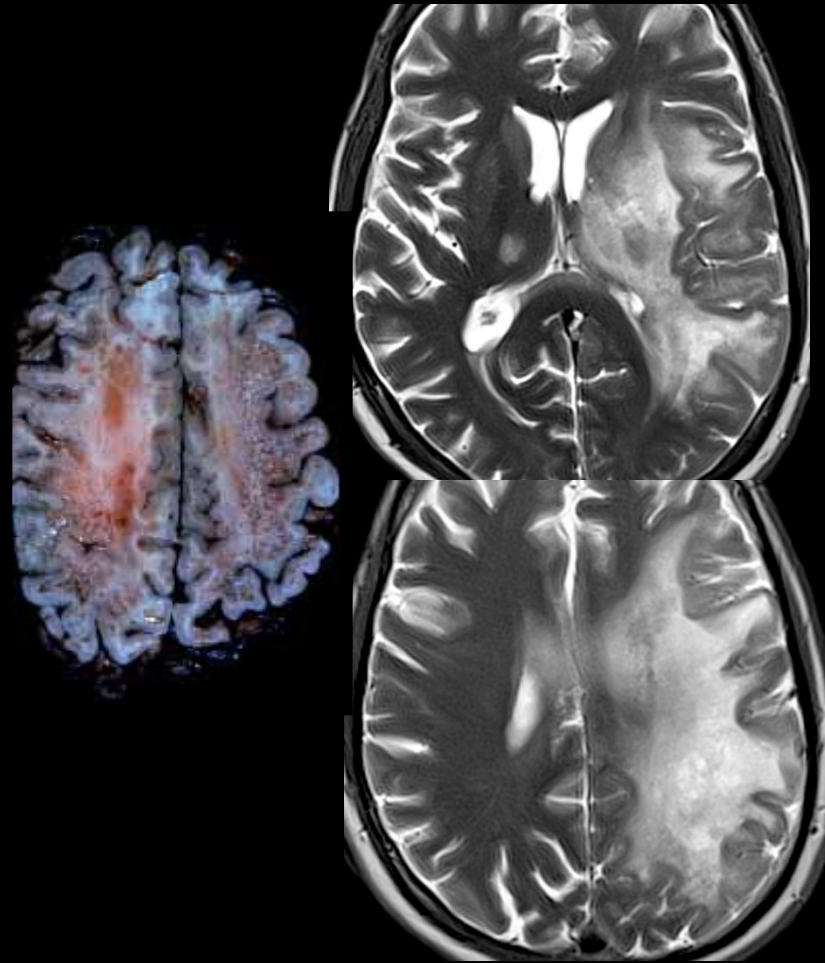
Krüptokokkoos

- Põhjustab seen *Cryptococcus neoformans*
- Algkõlle kops - hematogeenne levik ajuu
- Tsüstjad kolded ajus - *torulomas, cryptococcomas*



Progresseruv Multifokaalne Leukoentsefalopaatia PML

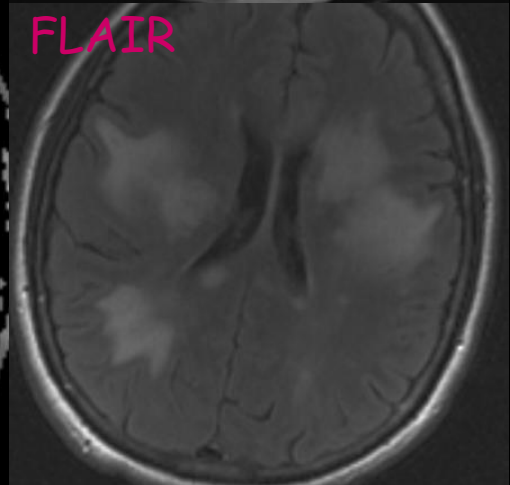
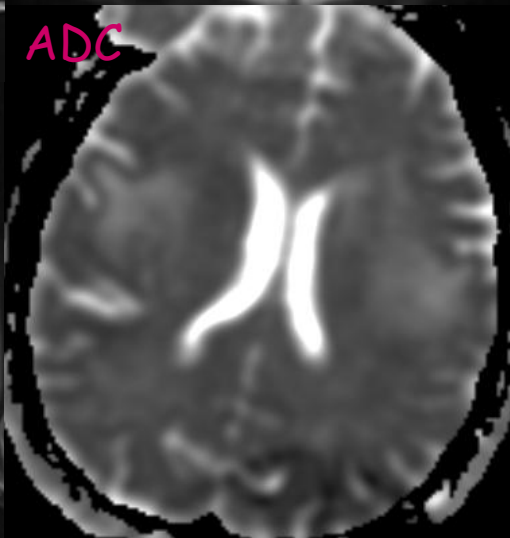
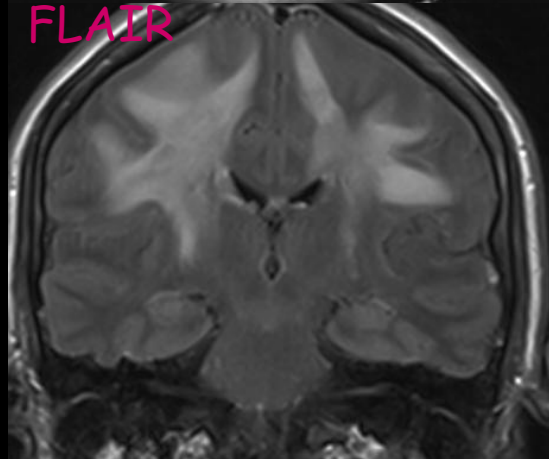
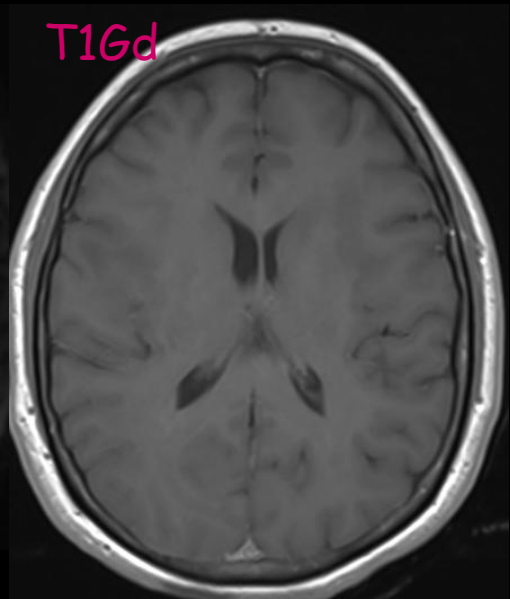
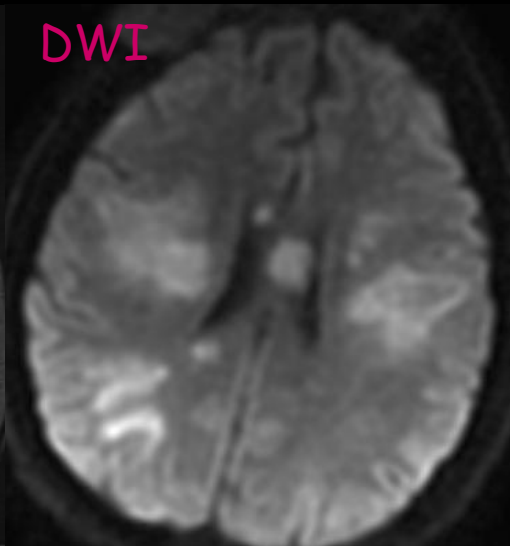
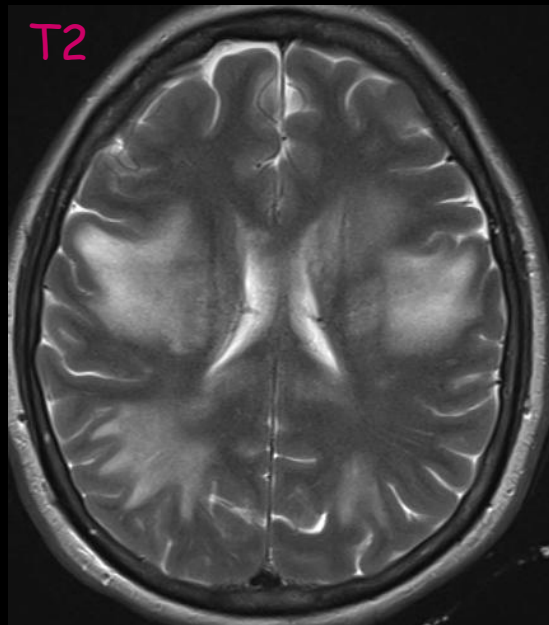
- Tavaliselt hilisstaadiumis
- 2%-7%
- John Cunningham viirus
JCV
- VA kolded
 - Bilateraalsed
 - Asümmeetrilised, pilvjad
 - Tavaliselt ei kontrasteeru
 - Ei ole massfekti, turset



JCV erinevad vormid KNS

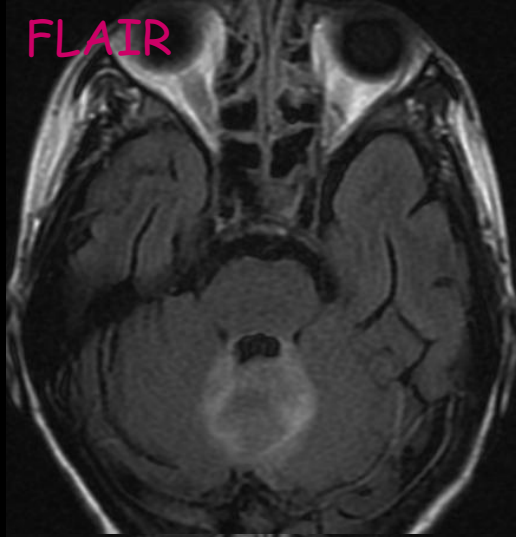
- **cPML** - klassikaline vorm
 - U-kiudude piirkonnas mittekontrasteeruvad pilvjad kolded
- **iPML** - põletikuline vorm
 - Lisandub perifeerne kontrasteerumine
 - Mitte HIV - halvem prognoos

cPML

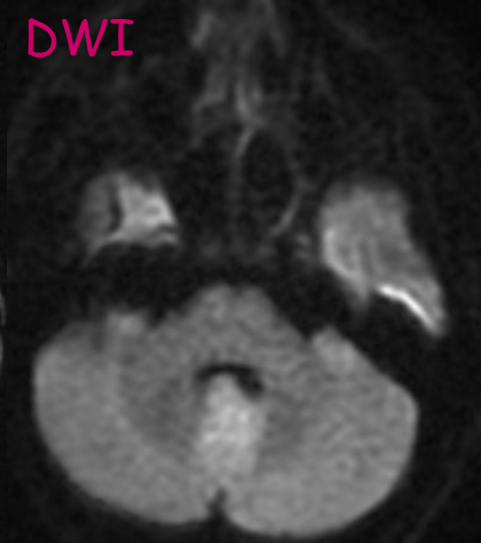


iPML

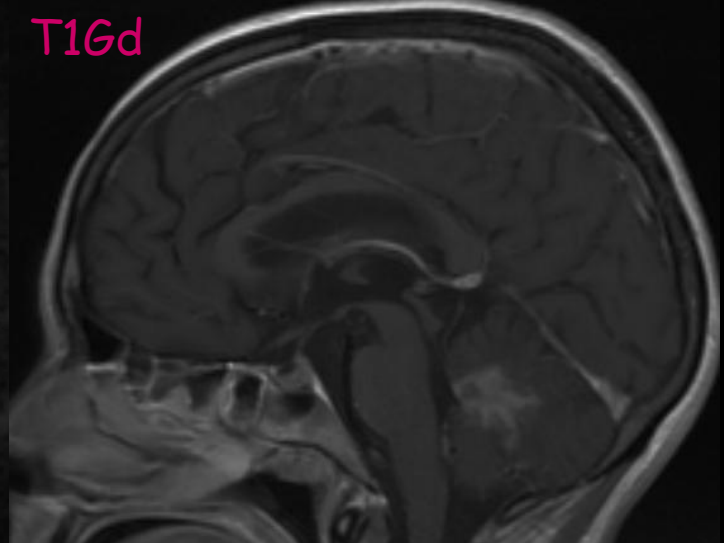
FLAIR



DWI



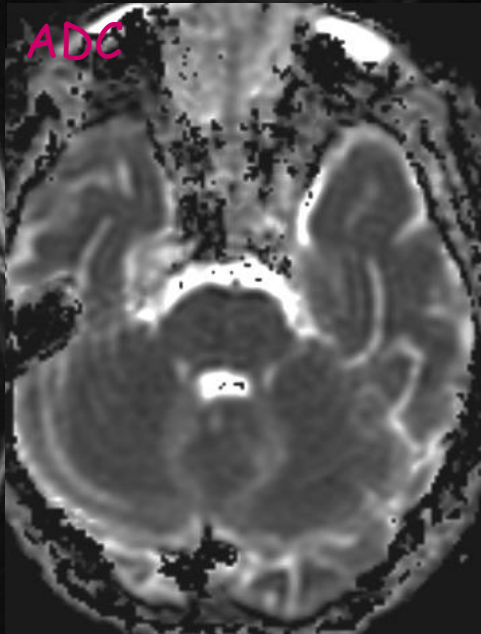
T1Gd



T2



ADC



T1Gd 3 kuud hiljem



PML

- Ka teistel immunosupprimeeritud haigetel
 - 80% HIV
 - 13% hematoloogilised haigused
 - 5% organtransplantatsioon
 - 3% bioloogilise ravi saajad
- Raske diagnoosida, eriti arengumaades
- HAART ravi on vähendanud PML-i AIDS-i haigetel

Immune Reconstitution Inflammatory Syndrome - IRIS

- HIV+ patsient kes alustab HAART
- Paradoksaalne kliiniline halvenemine
 - Vaatamata ↑CD4+ arv, ↓ HIV viiruse hulk
- Tavaliselt koos oportunistliku infektsiooniga
 - PML-IRIS
 - TB-IRIS
 - Crypto-IRIS

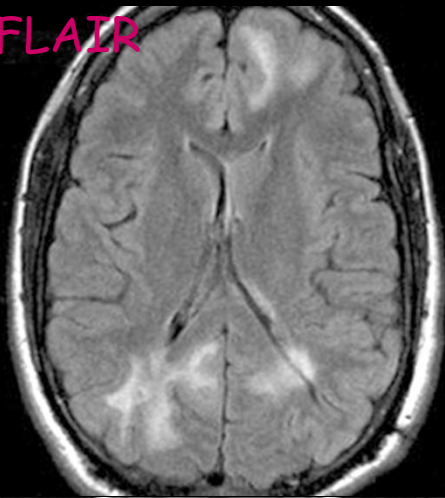
Johnson T, Nath A: Neurological complications of immune reconstitution in HIV-infected populations. *Ann NY Acad Sci* 1184: 106-20, 2010

Marais S et al: Neuroradiological features of TB-associated immune reconstitution inflammatory syndrome. *Int J Tuberc Lung Dis* 14: 188-96, 2010

PML-IRIS

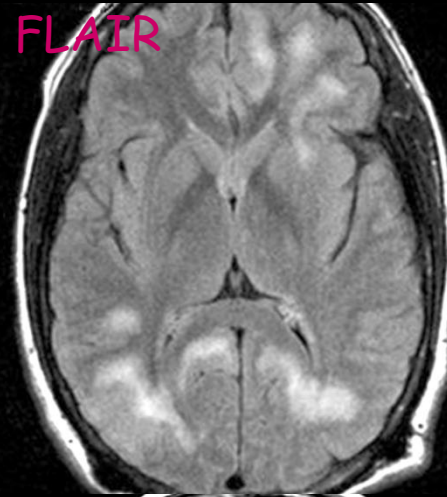
Enne ravi

FLAIR

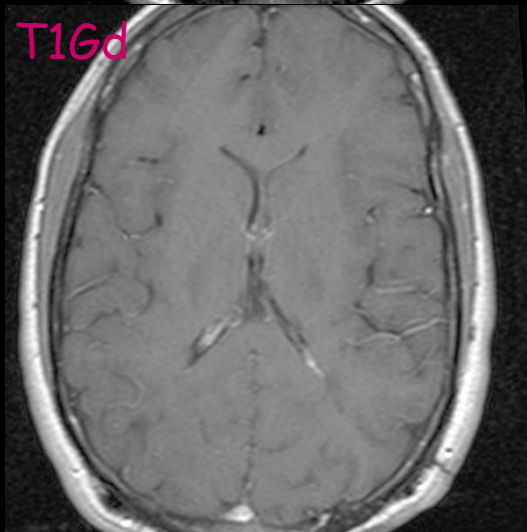


Peale HAART

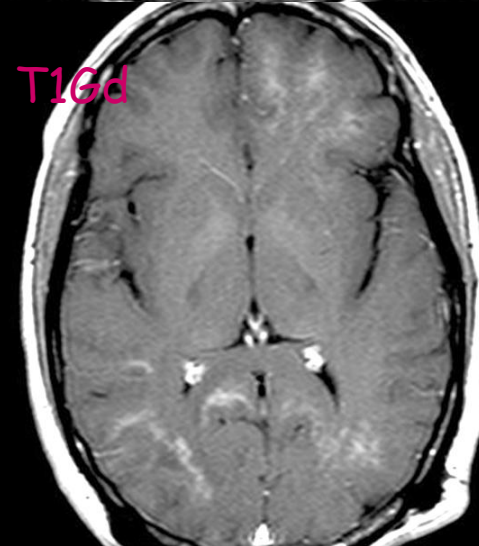
FLAIR



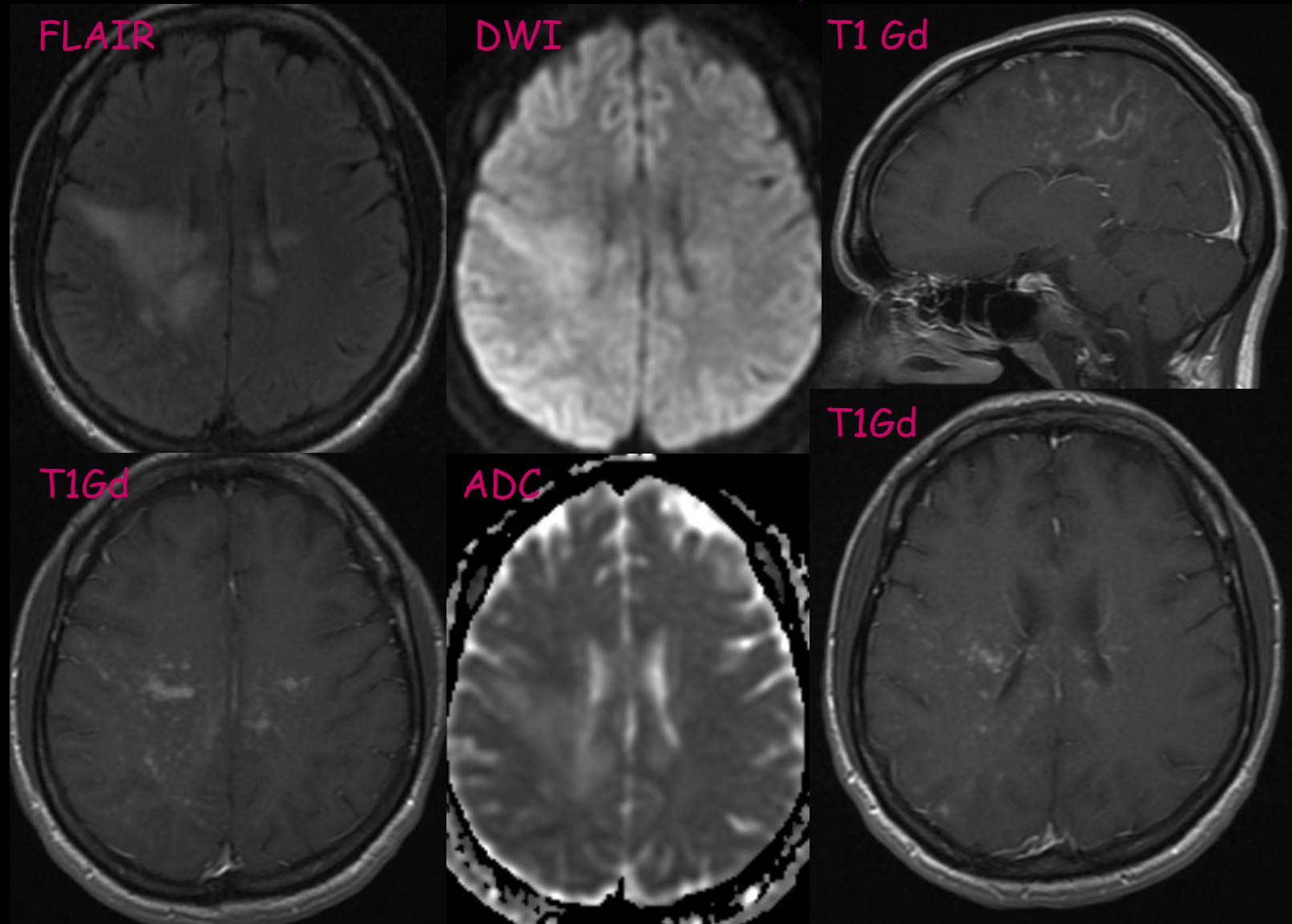
T1Gd



T1Gd



iPML + IRIS 1 kuu peale HAARTi



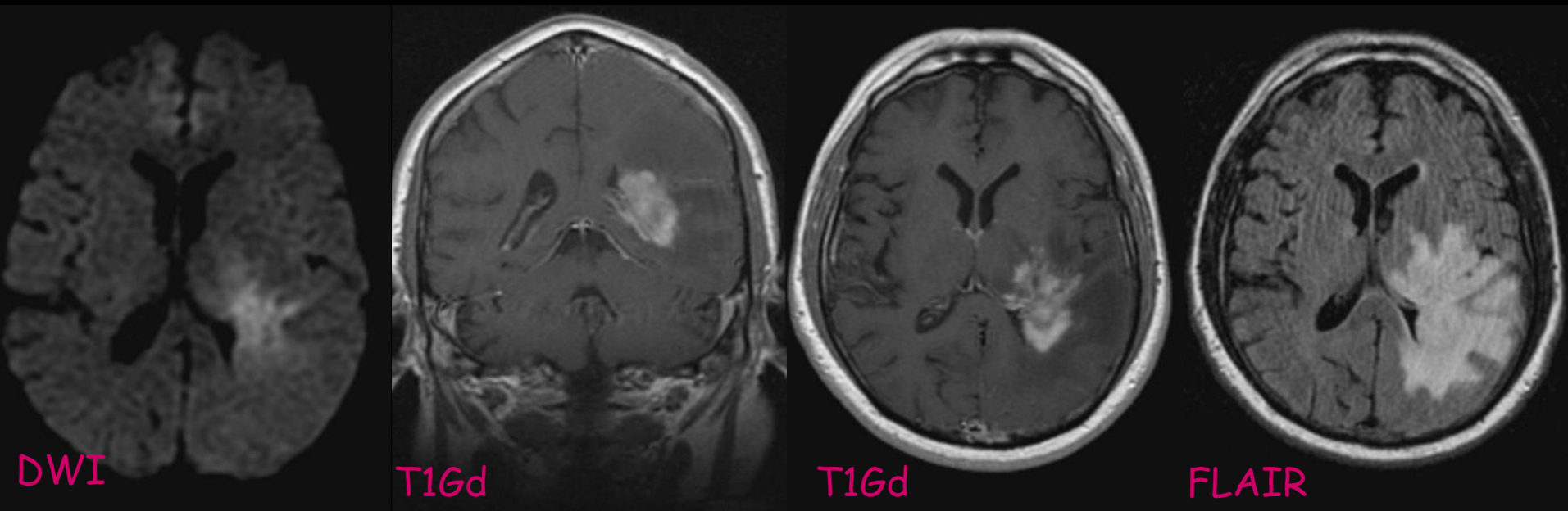
KNS lümfoom AIDS

- Sagedus tõuseb!
- 70% aju üksikkolletest!
- Erinev leid
 - Hemorraagia
 - Nekroos
 - +/- vähene kontrasteerumine
- DDX:
toksoplasmoos

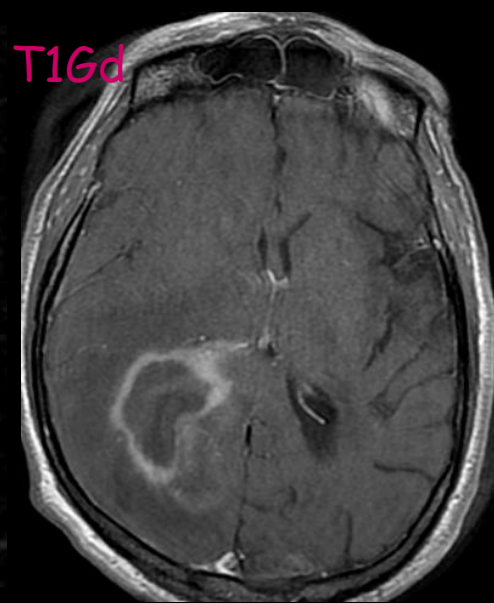
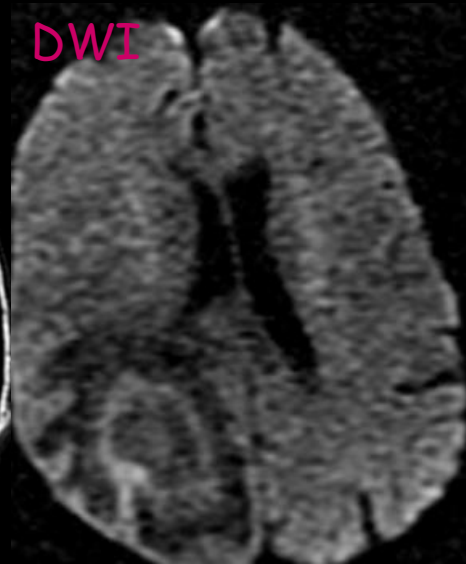
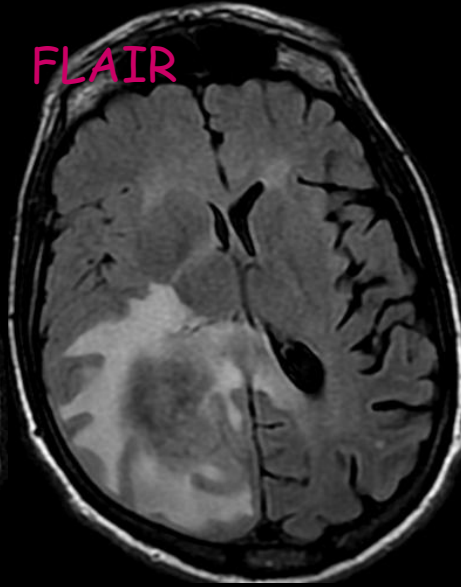
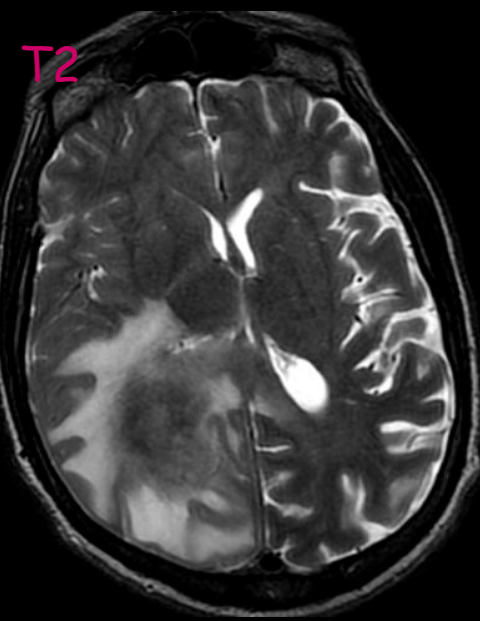


AIDS/HIV lümfoom

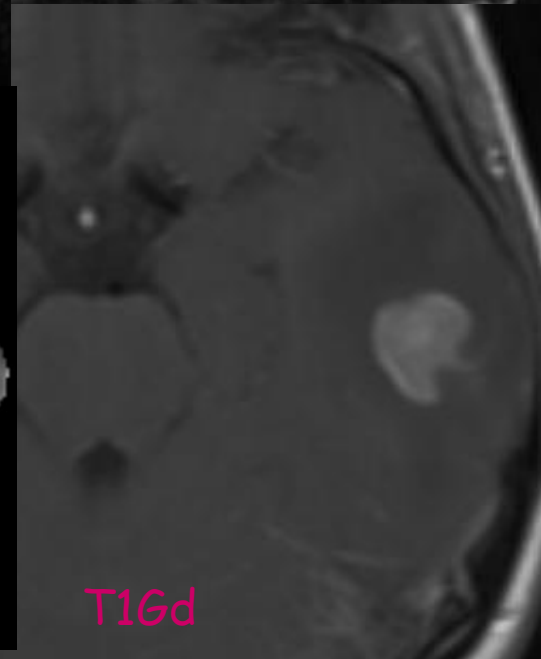
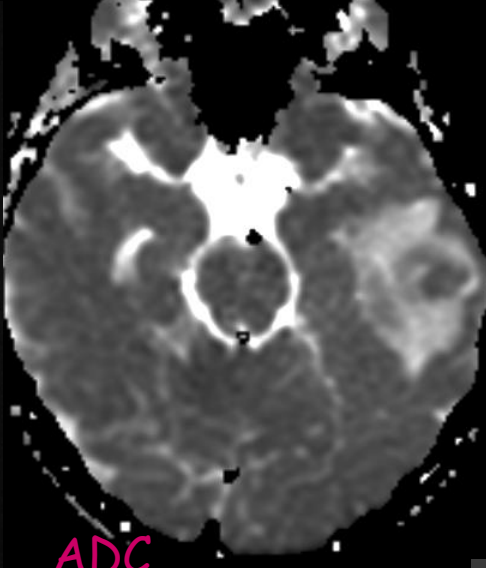
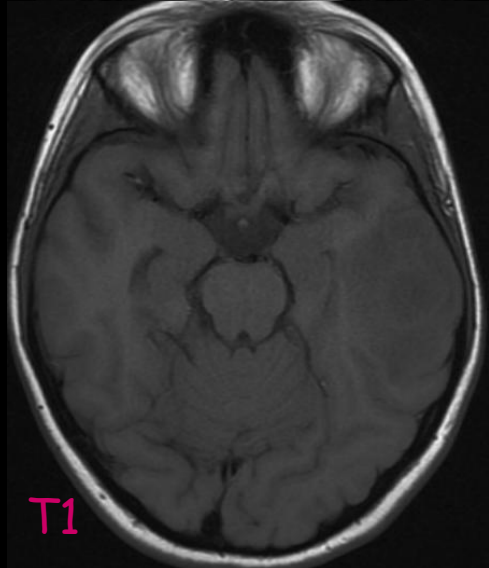
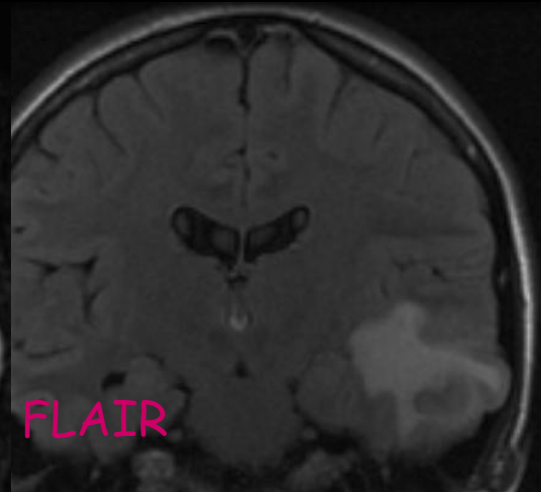
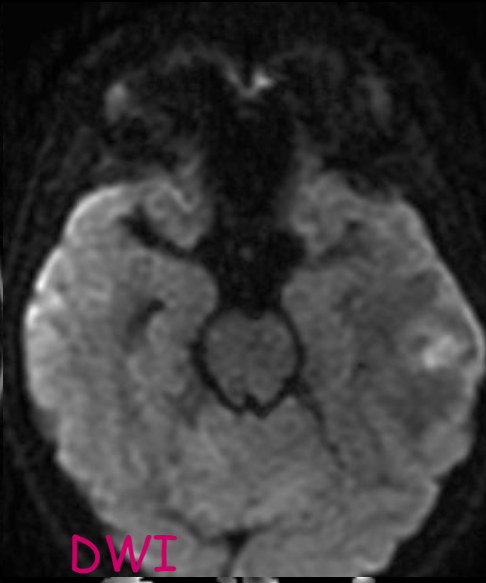
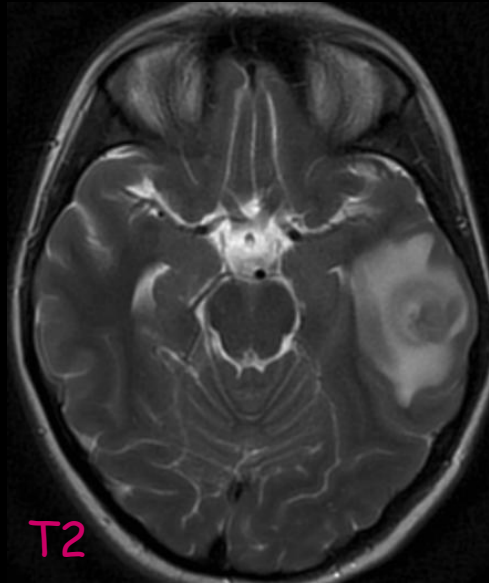
- AIDS-i haigetel tsentraalne nekroos
- Subependümaalne kontrasteerumine DDX toksoplasmoos
- Kolded tavaliselt suured: sõlmelised, lainelised



AIDS/HIV lümfoom

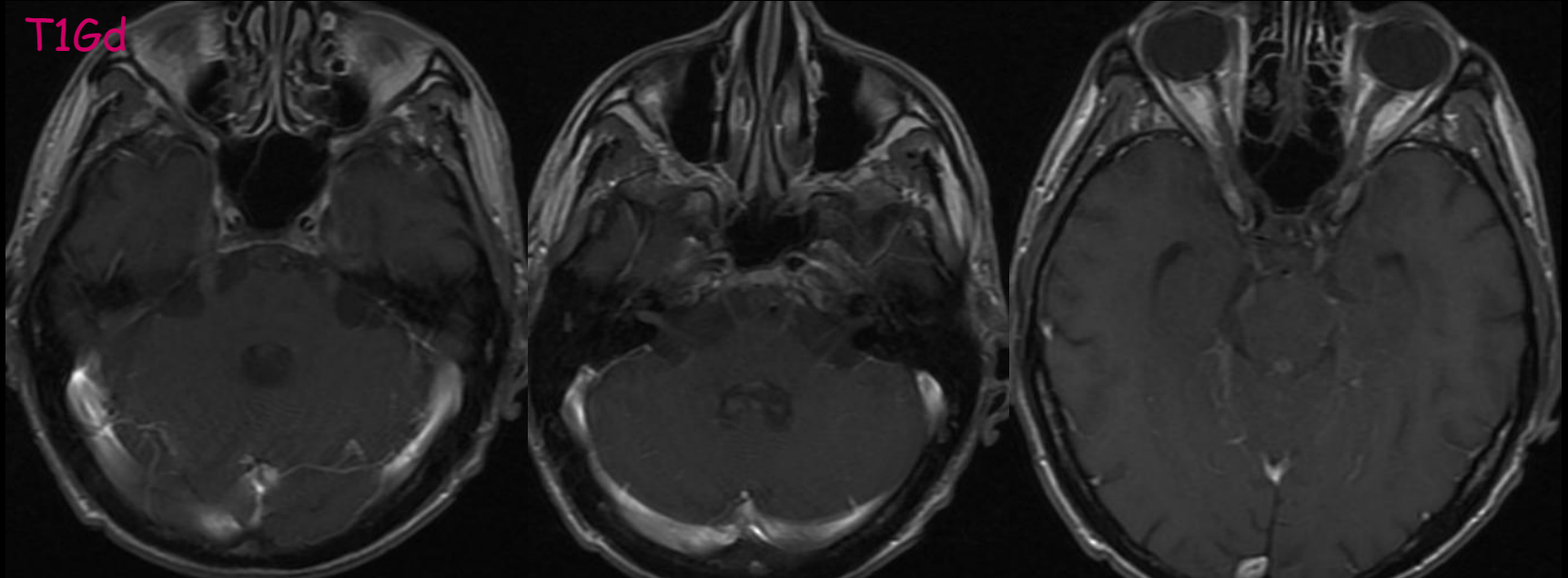


AIDS/HIV lümfoom

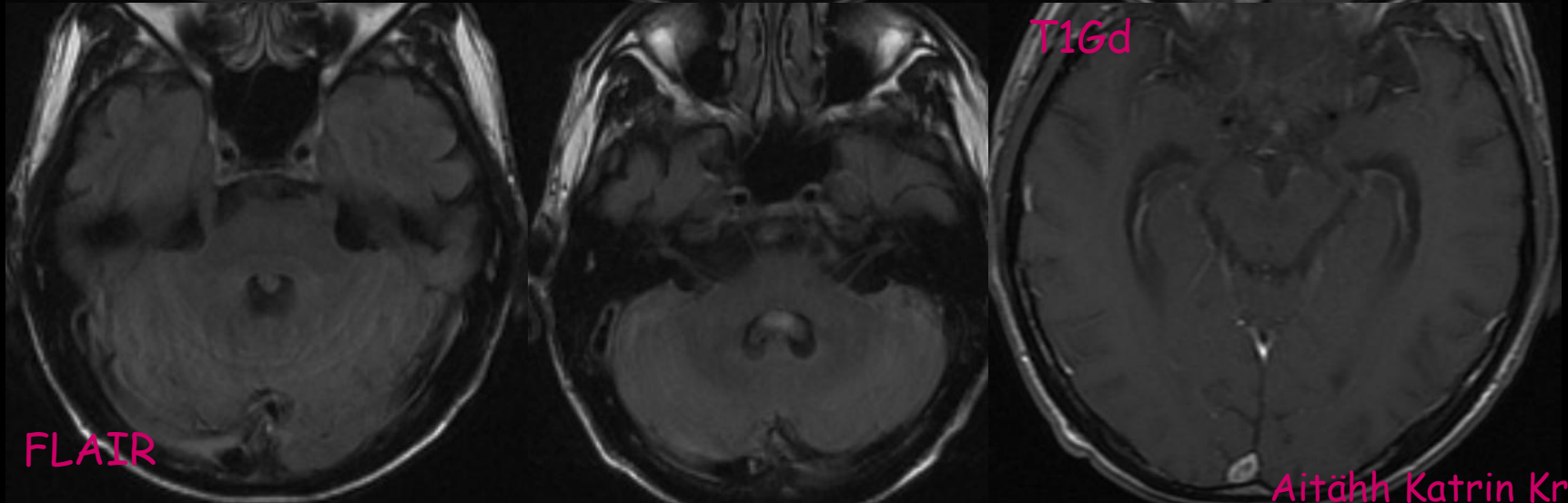


Burkitti lümfoom

T1Gd



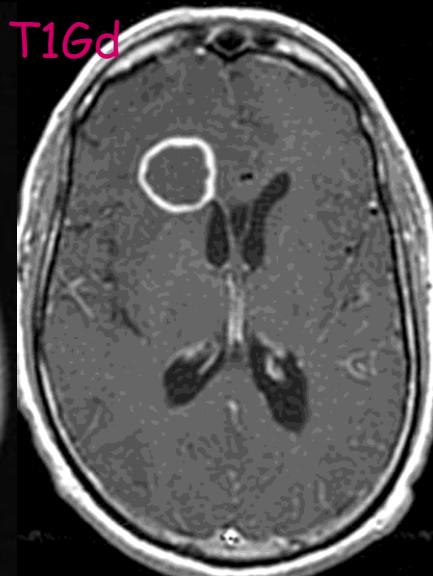
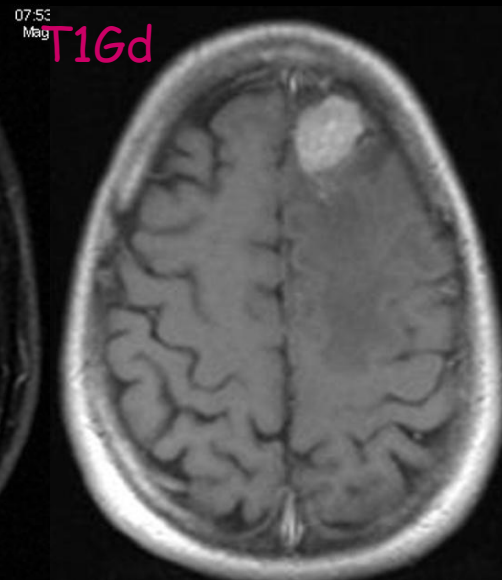
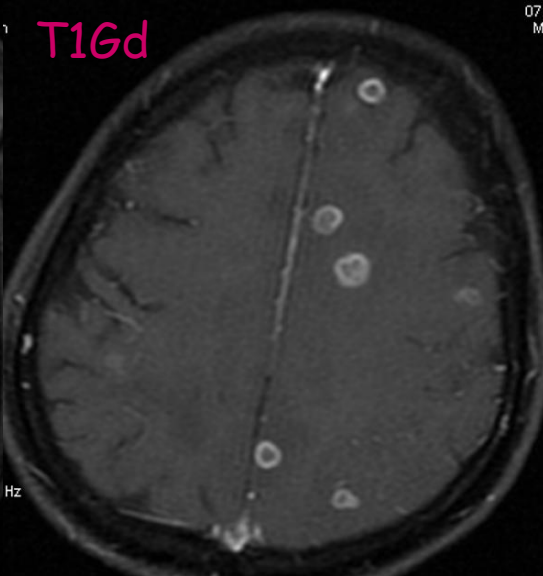
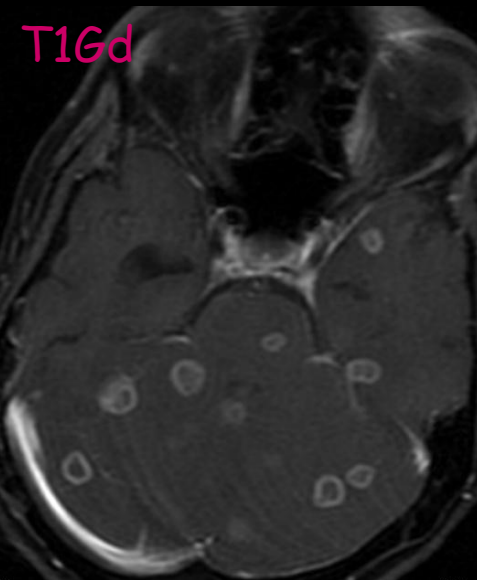
T1Gd



FLAIR

Abstsessid AIDS

- Parasiidid, mükobakterid, seened
- Sarnased tavalistele abstsessidele
- Ekstrapulmonaalne TBC, KNS TBC



Neuroinfektsioonid

- Meningiit
- Abscess
- Ajuväliste ruumide põletik
- Entsefaliit
- Tsüstjad lesioonid
- AIDS-iga seotud infektsioonid
- *Neuroborrelioos, Lyme tõbi*

Neuroborreliosis, Lyme tõi

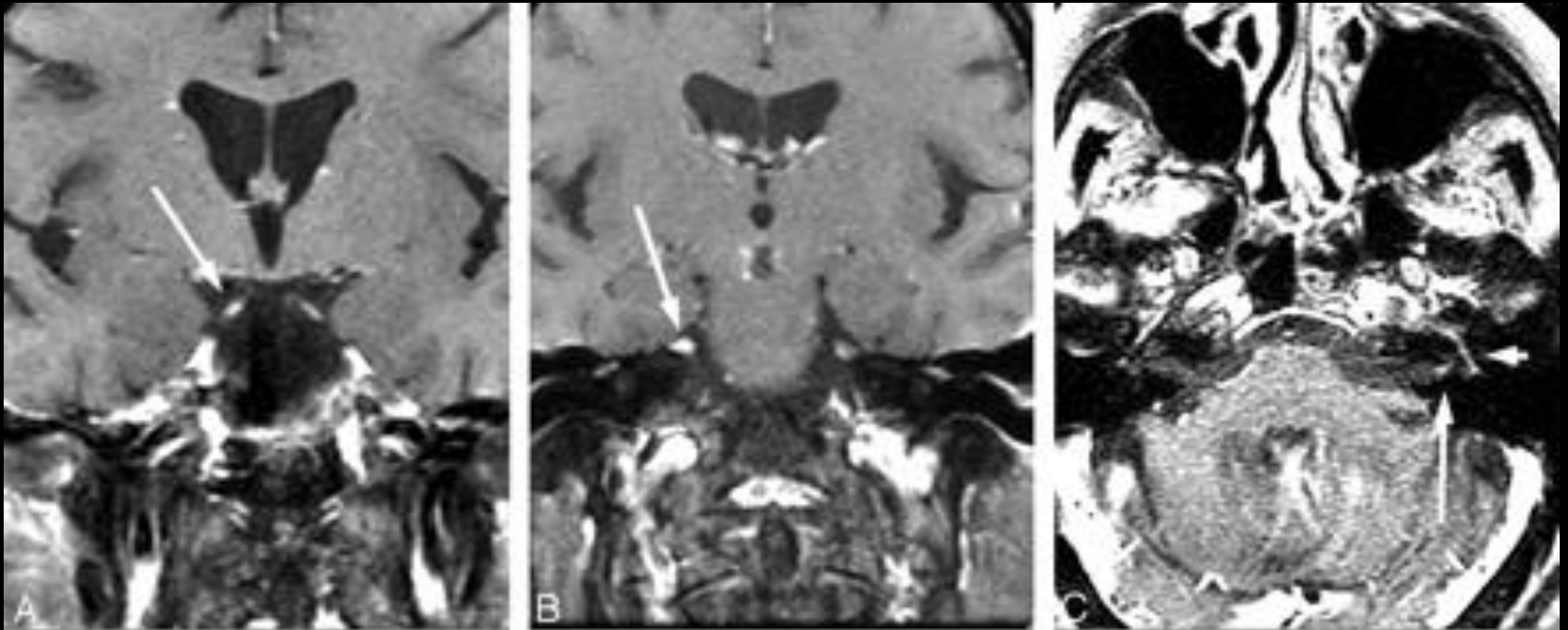
- Puukide poole edasikantav multisüsteemne põetikuline haigus
- Spiroheet *Borrelia burgdorferi sensu stricto*, *B. garinii*, *B. afzelii*
- Kliiniliselt:
 - Migreeruv erüteem
 - Meningopolüneuriit
 - Krooniline atroofiline akrodermatiit

KNS haaratus

- 3 - 4 nädalat peale nahaleidu
- 10 - 15% saab KNS haaratuse
- Põletik:
 - dorsaalne närvijuure ganglion → närvijuur → leptomeningid
- Kliiniliselt meningiit ja radikuliit
- Ühe > kahepoolne kraniaalnärvide haaratus enim VII närv, III, V vähem

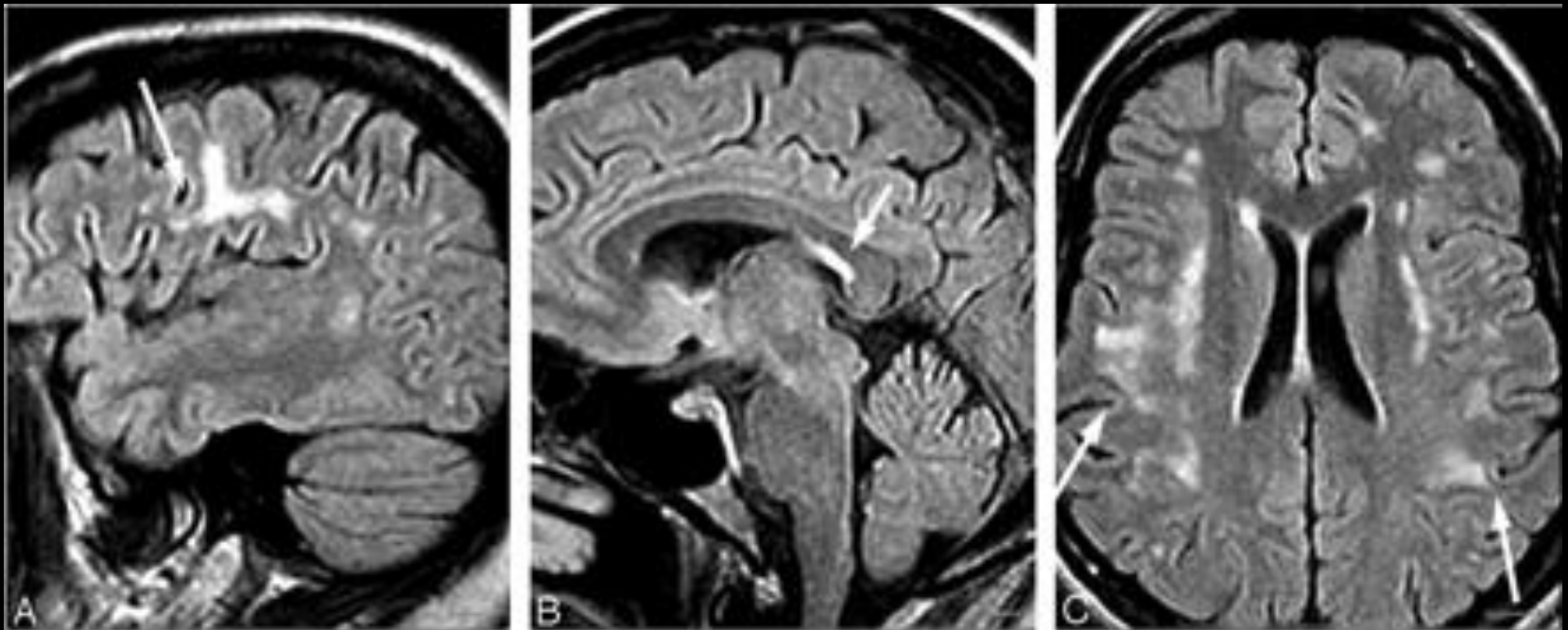
Neuroborrellioos, Lyme tõbi

- Kahepoolne näonärvi halvatus, peavalu ja eelnev erüteem
- DDX - sarkoidoos



Neuroborrellioos, Lyme tõbi

- Ca 50% mittespetsiifiline leid ajus:
 - bifrontaalne valgeaine koldeline muutus
 - U-kiudude, CC haaratus
 - Periventrikulaarseid koldeid pole
 - DDX MS



VÕTA KOJU KAASA

- KNS infektsioonid jätkuvalt probleemiks
- Haigused ravitavad
 - varajane diagnoos ja ravi
- AIDS - peamine põhjus
- MRT oluline
 - leiu kirjeldus ja lokalisatsioon - viide tekitajale



Lugemiseks

- Radiopaedia.org
- Diagnostic Imaging BRAIN
- **Cerebral Infections** Karampekios S. Et al *European Radiology* 2005
- **JC Virus Infection of the Brain** A.K. Baga, J.K. Curéa, et al *AJNR Am J Neuroradiol* 2010
- **Lyme Neuroborreliosis: Manifestations of a Rapidly Emerging Zoonosis** P. Hildenbrand et al *AJNR Am J Neuroradiol* June 2009
- **From the Archives of the AFIP: Continuing Medical Education: Central Nervous System Infections Associated with Human Immunodeficiency Virus Infection: Radiologic-Pathologic Correlation** Alice B. Smith, James G. Smirniotopoulos *Radiographics* November-December 2008