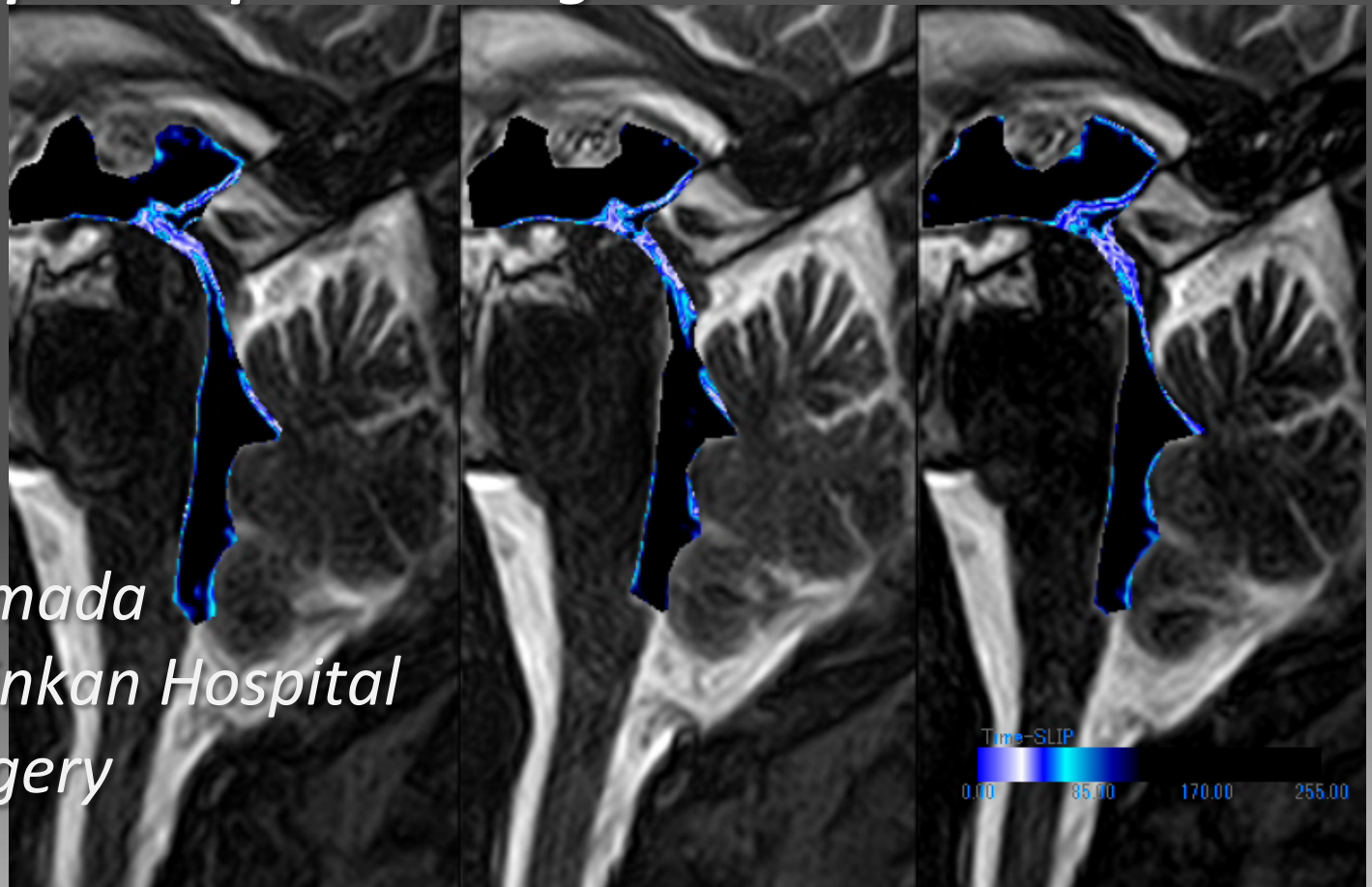


CSF dynamics in normal pressure hydrocephalus

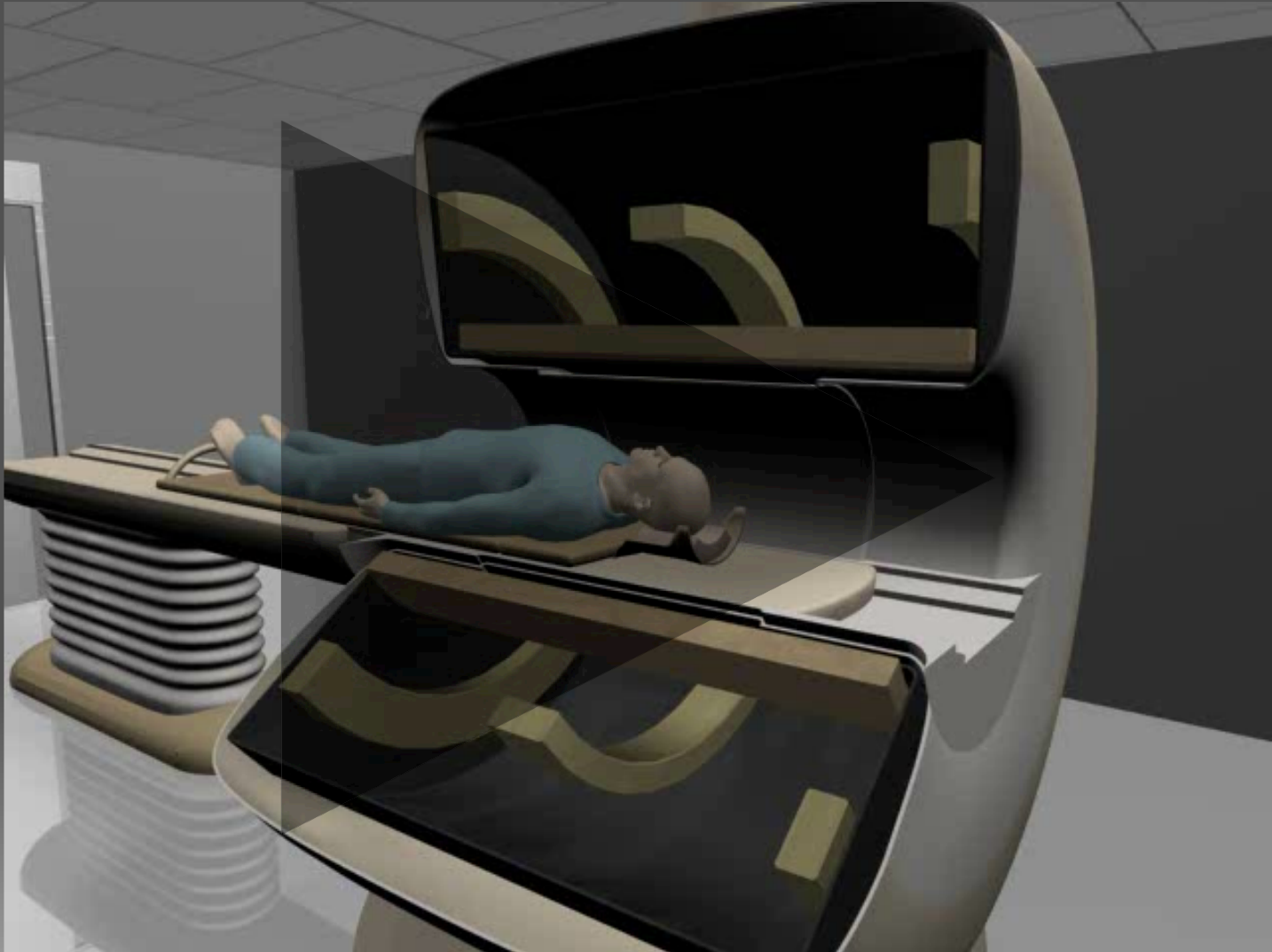
Arterial Spin Labeling MRI observation

Time Spatial Spin Labeling: Time-SLIP



Shinya Yamada
Toshiba Rinkan Hospital
Neurosurgery

What is Time-SLIP?

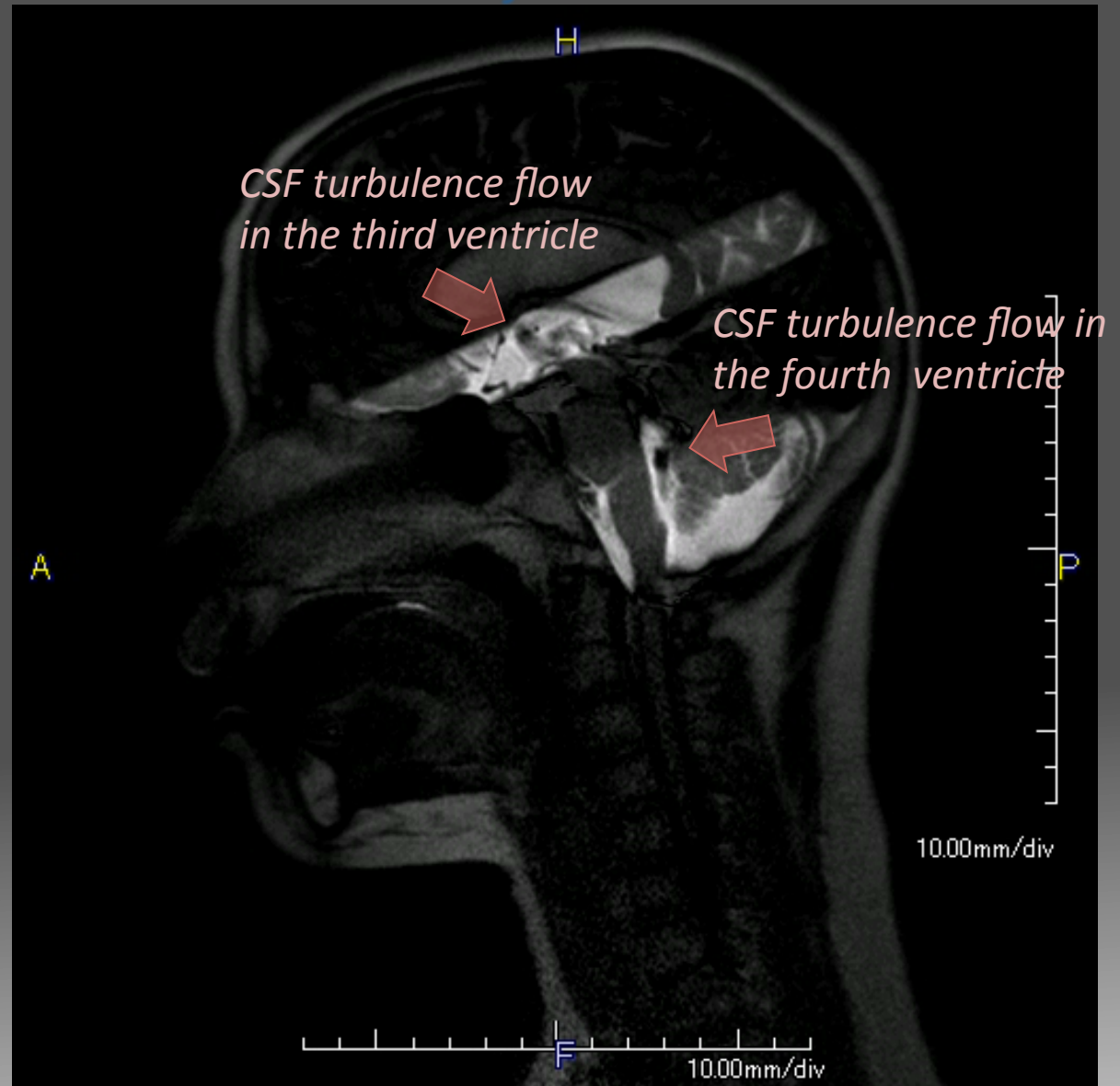
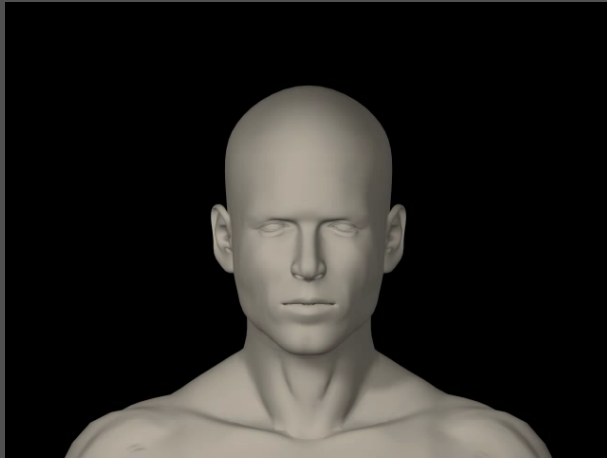


CSF reflux flow into the lateral ventricles



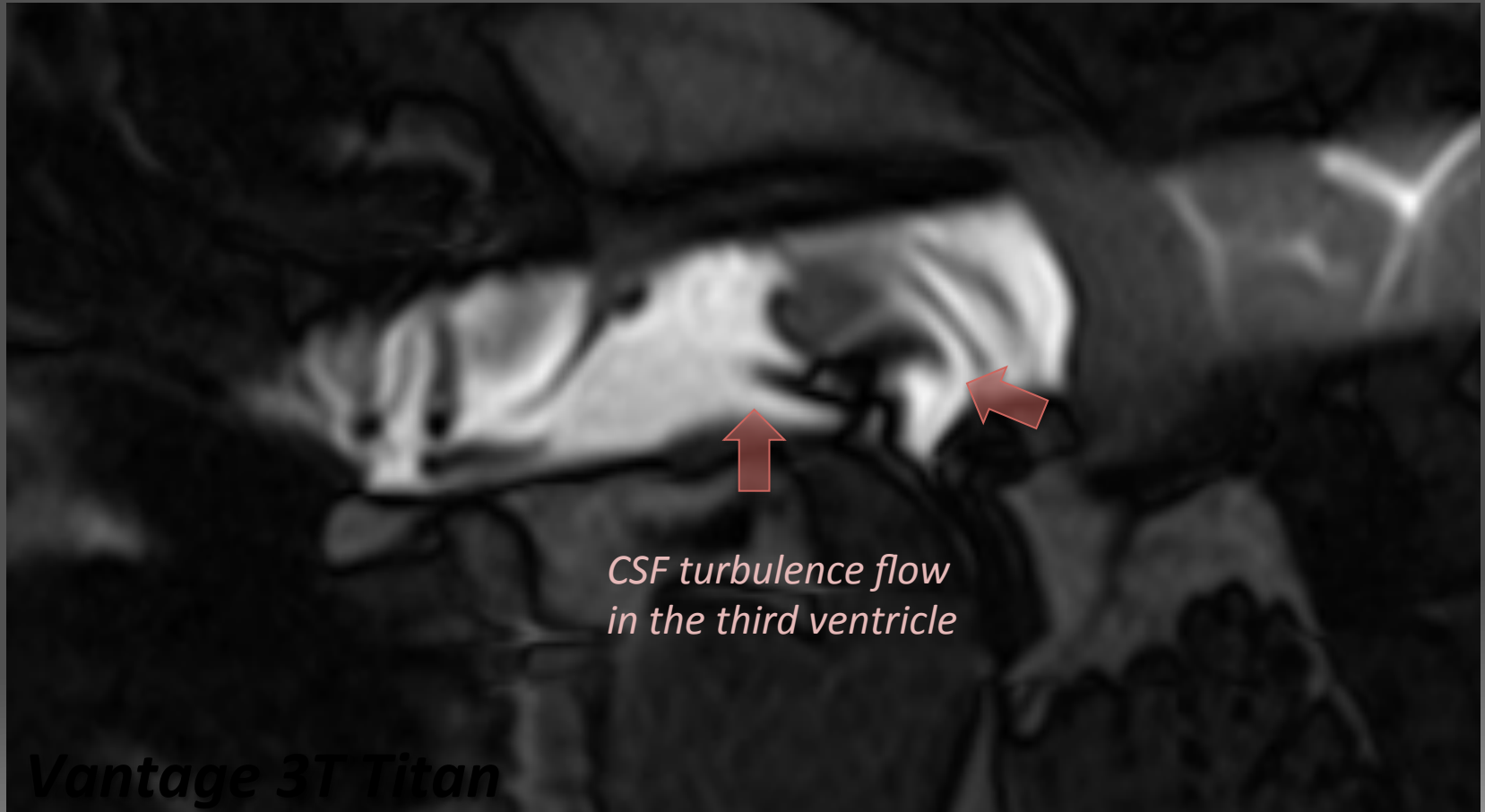
Normal CSF hydrodynamics

CSF flow in the third ventricle to the fourth ventricle



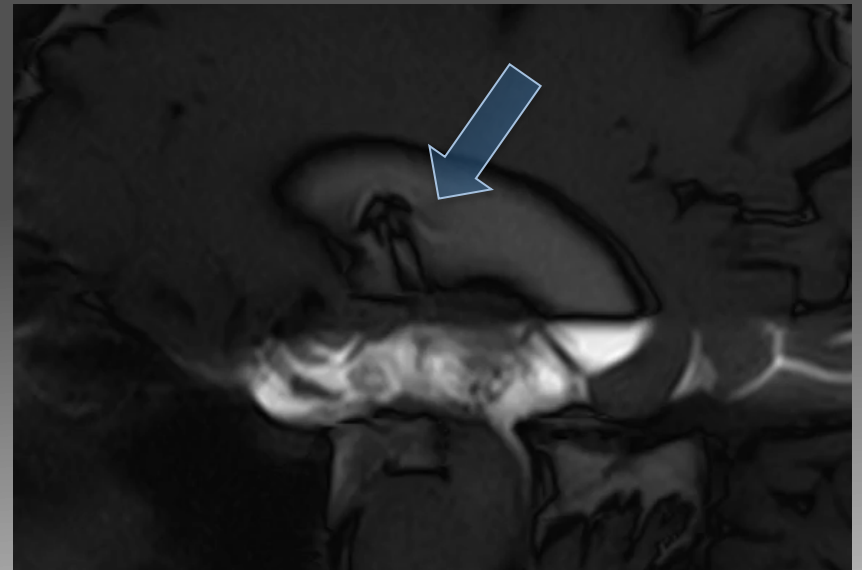
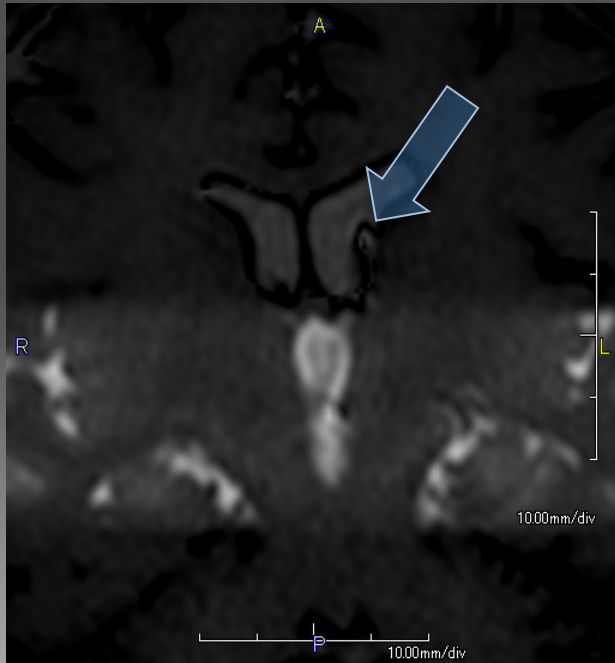
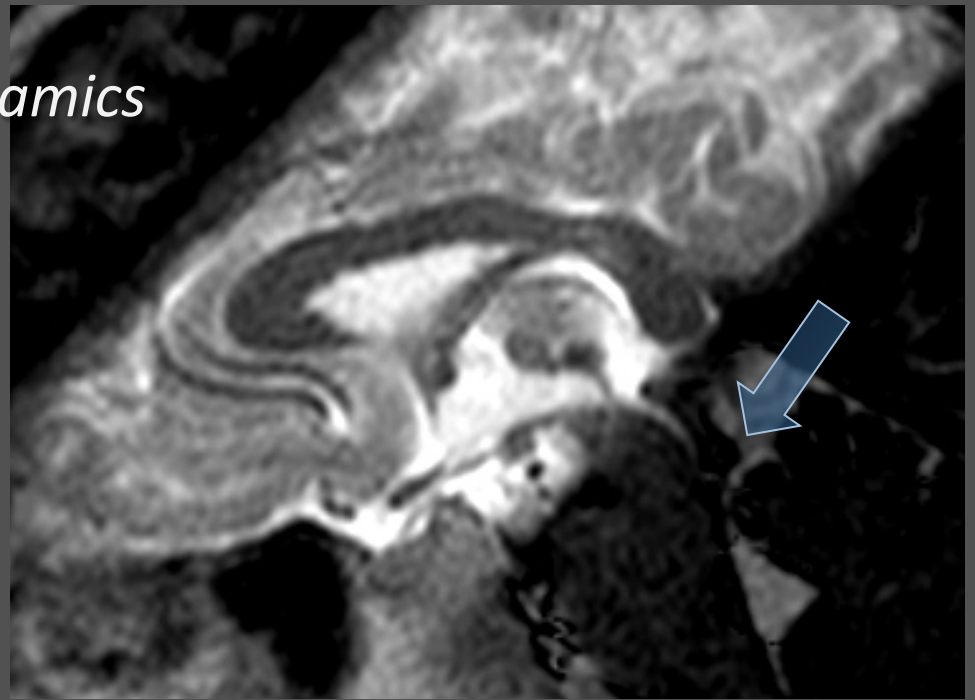
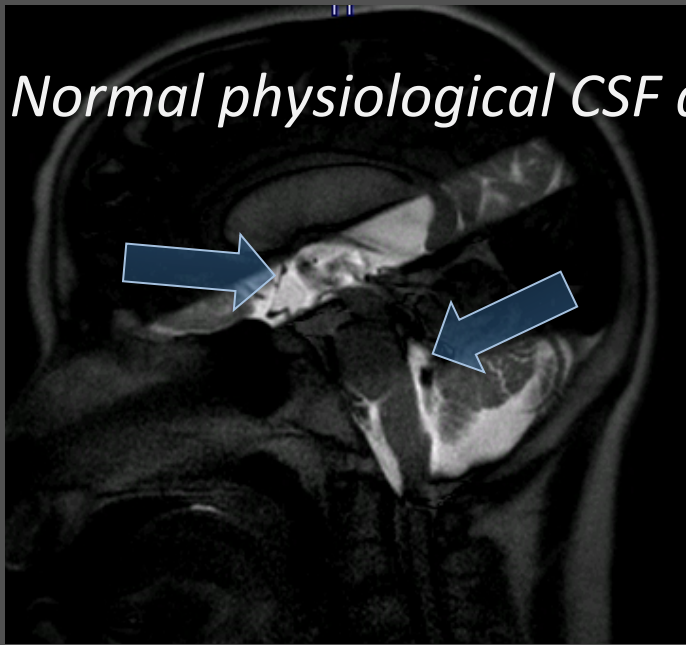
Normal CSF hydrodynamics

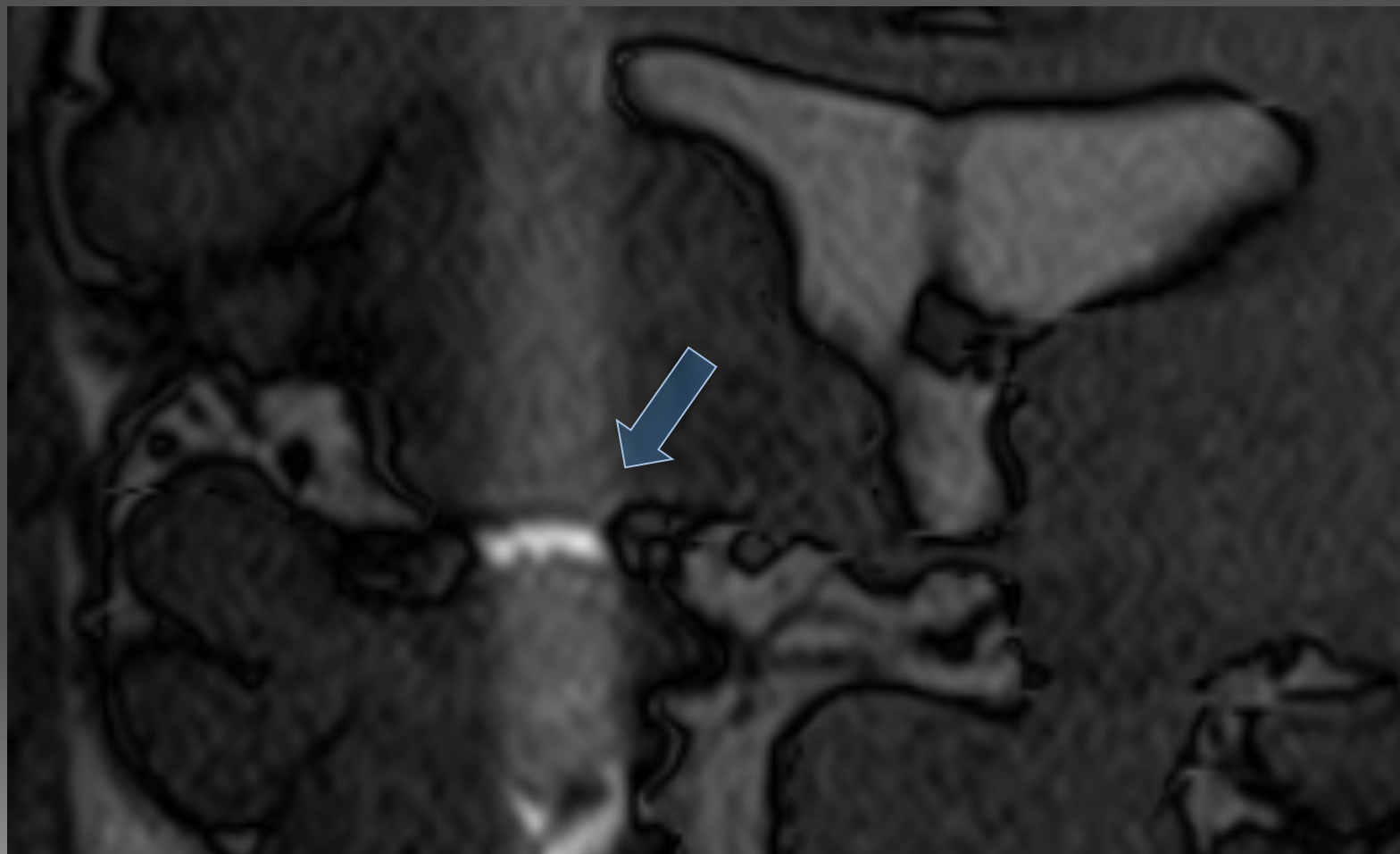
CSF turbulence flow in the third



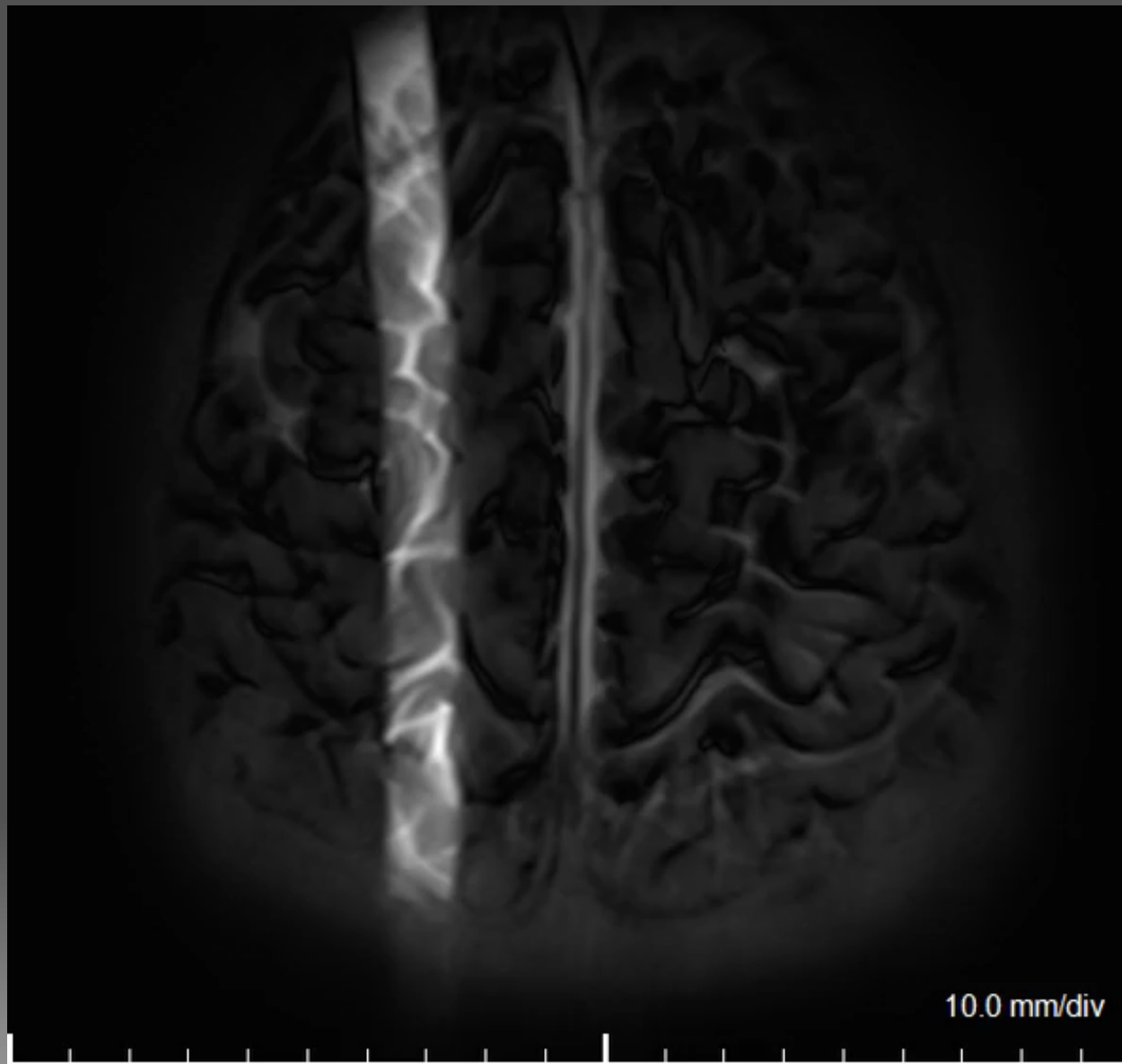
Normal CSF dynamics

Normal physiological CSF dynamics





Normal CSF hydrodynamics



Normal CSF hydrodynamics

Material and methods

Thirty-one patients who previously experienced SAH were studied

total mean age:66 female vs. male 20:10

NON-HY GROUP

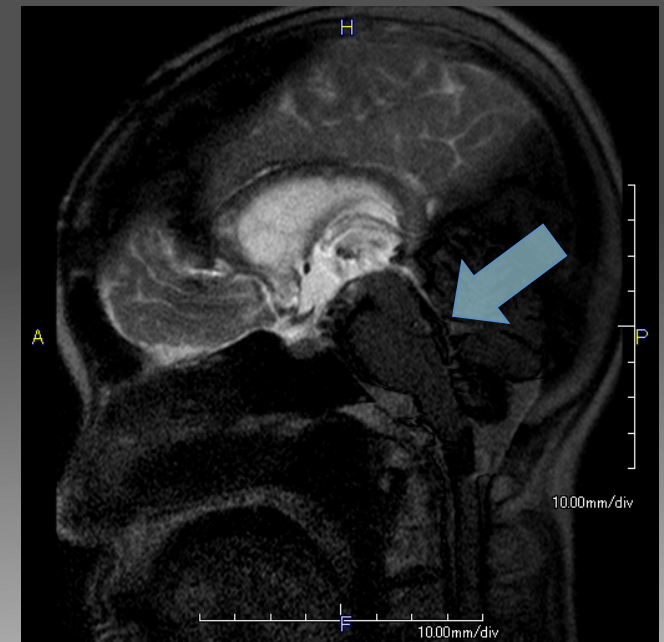
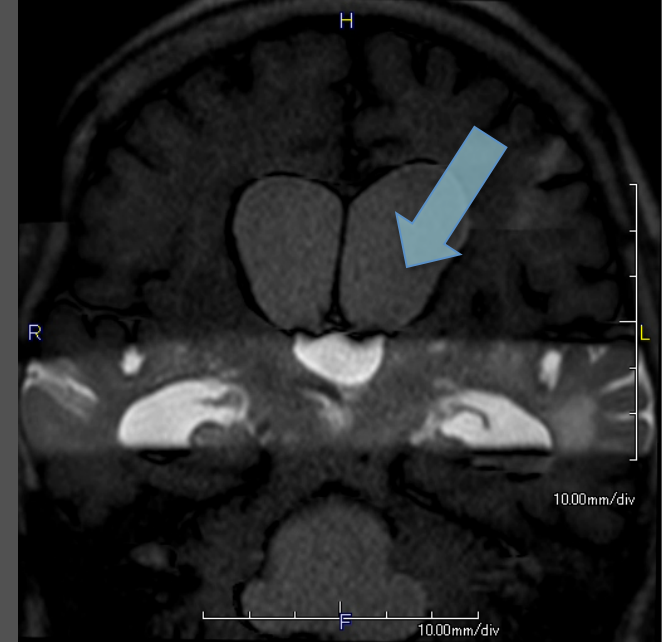
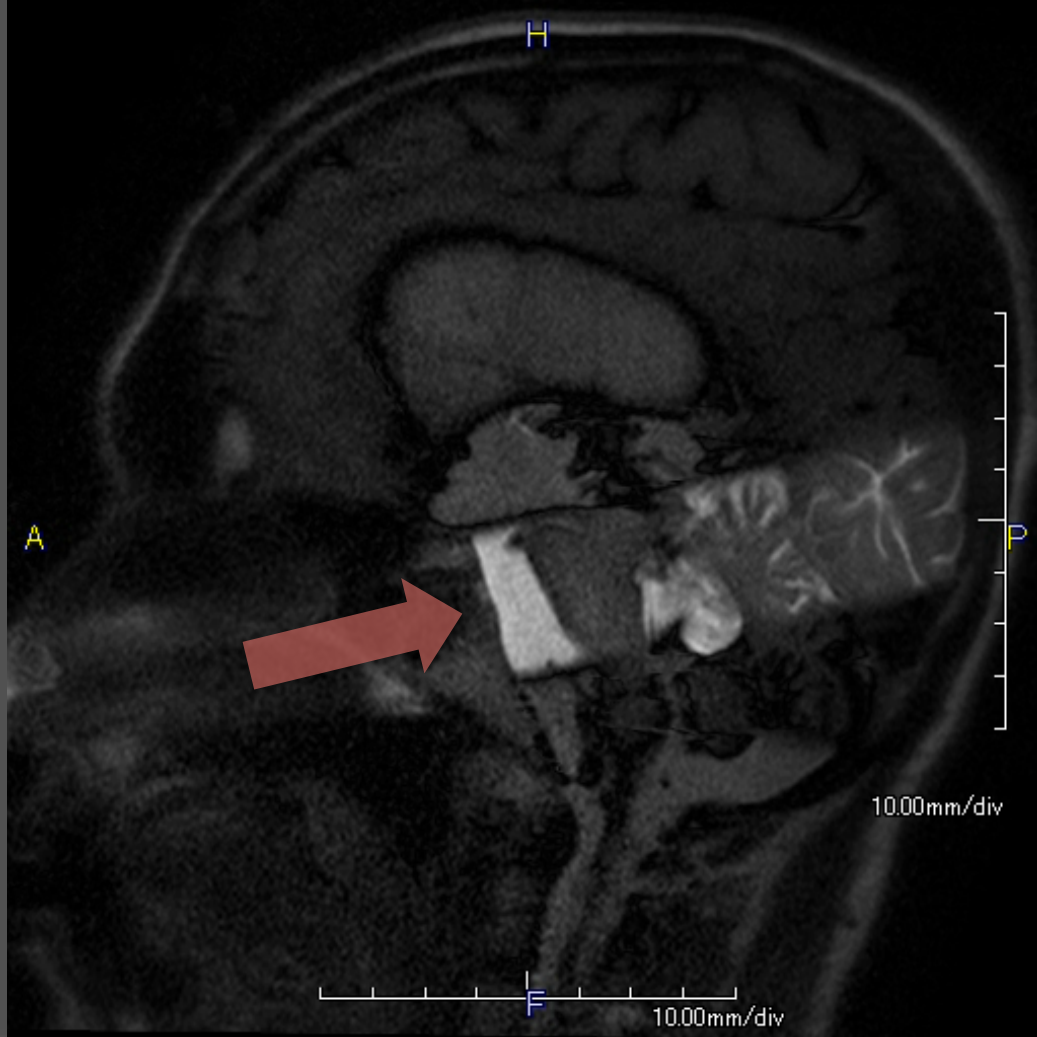
12/30 (40%) did not developed hydrocephalus.

mean age 64 female vs. male: 7:5

HY GROUP

18/30 (60%) patients required the insertion of a ventriculo-peritoneal shunt for progressive hydrocephalus.

mean age 68 female vs. male 13:5



*CSF dynamics: Hydrocephalus
Secondary to SAH*

Alterations of CSF dynamics in NPH secondary to SAH

Aqueduct

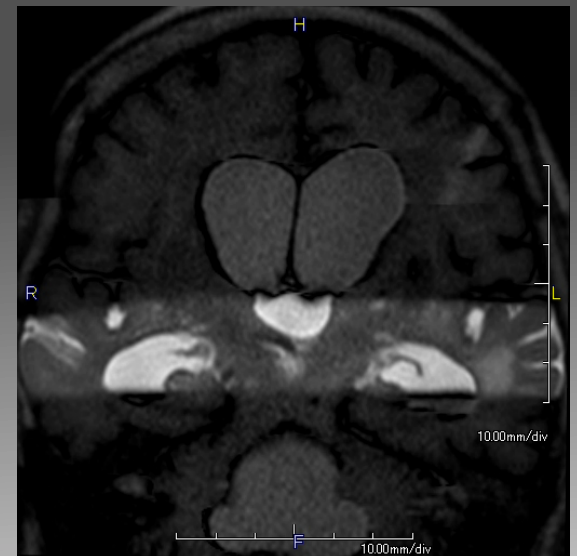
Faster CSF movement through the aqueduct were seen approximately half of the cases.



Alterations of CSF dynamics in NPH secondary to SAH

Foraminae of Monro

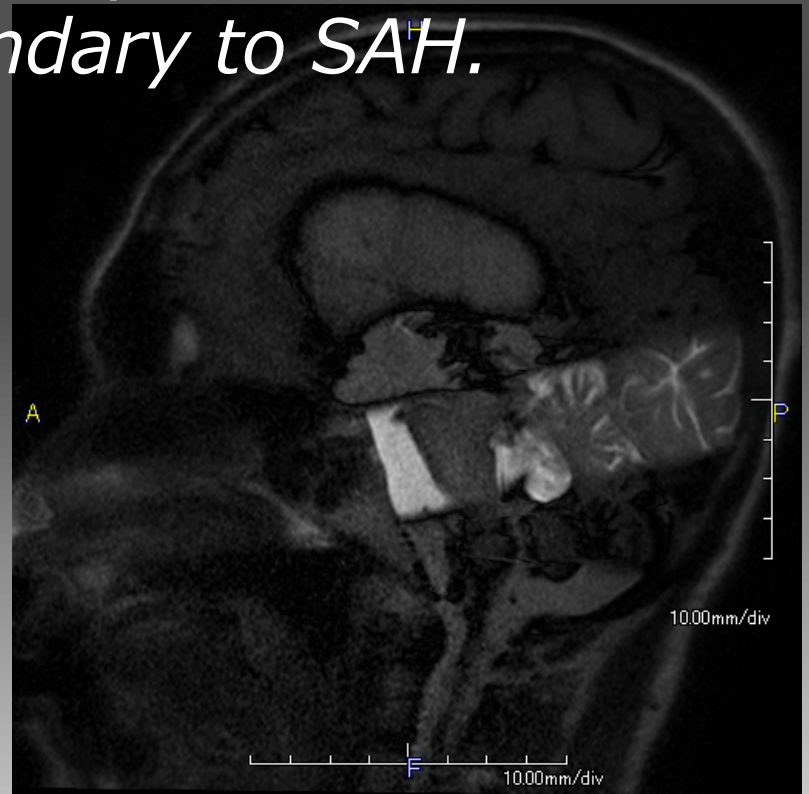
Abnormal CSF reflux movement through the foraminae of Monro were often seen in NPH secondary to SAH.



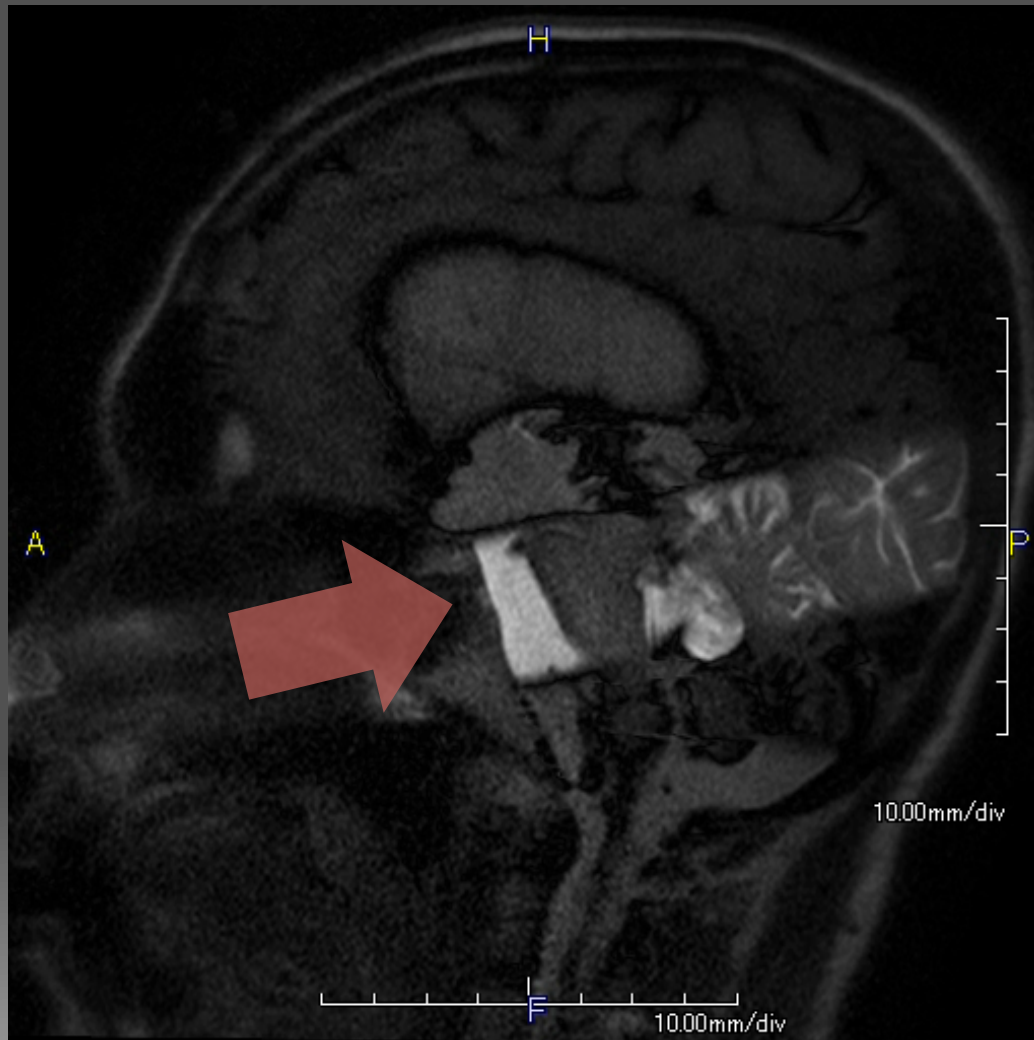
Alterations of CSF dynamics in NPH secondary to SAH

Prepontine cistern

CSF movements in the prepontine cistern was blocked in NPH secondary to SAH.

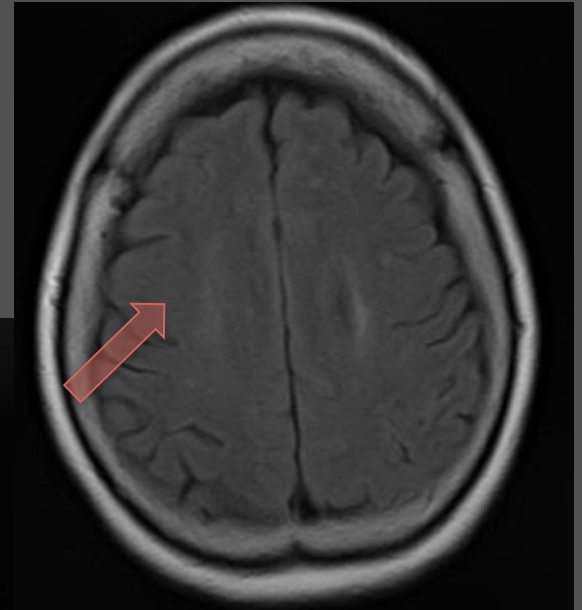
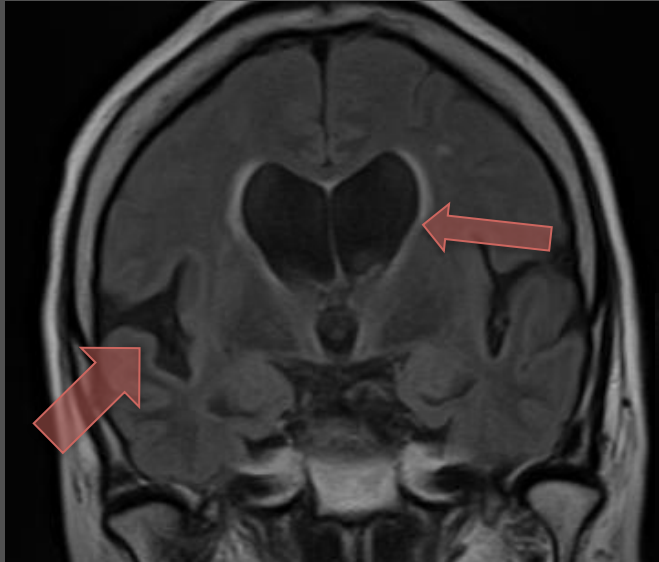


Alterations of CSF dynamics in NPH secondary to SAH



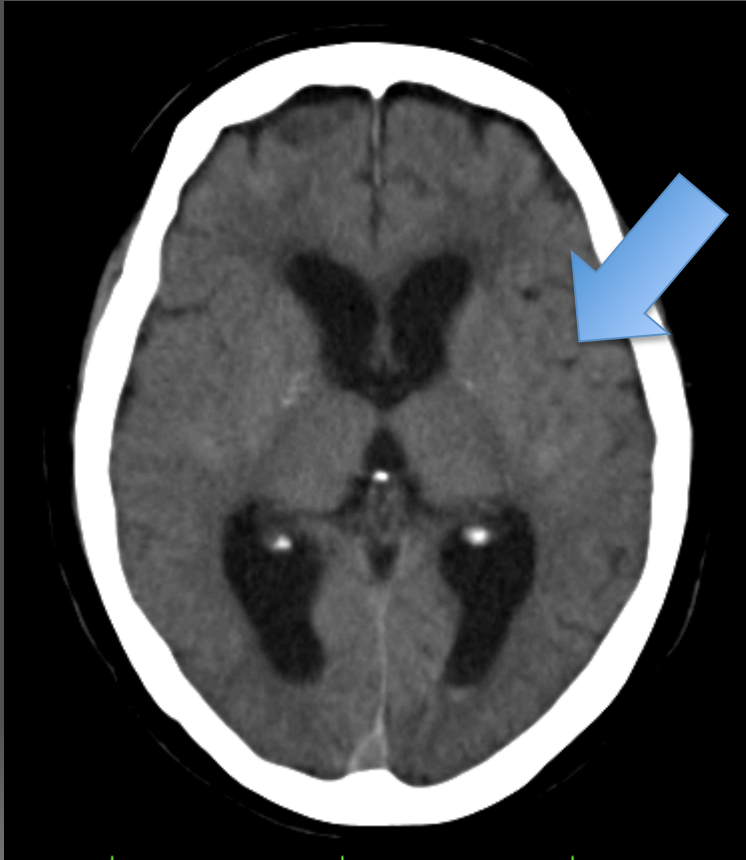
Extra-ventricle intra-cisternal obstructive hydrocephalus

No CSF flow over the cerebral convexity



DESH: disproportionately enlarged subarachnoid-space hydrocephalus

Hydrocephalus



Secondary to SAH



idiopathic

*Eleven Definitive (Improvement following CSF diversion)
iNPH patients were studied*

Female: 5

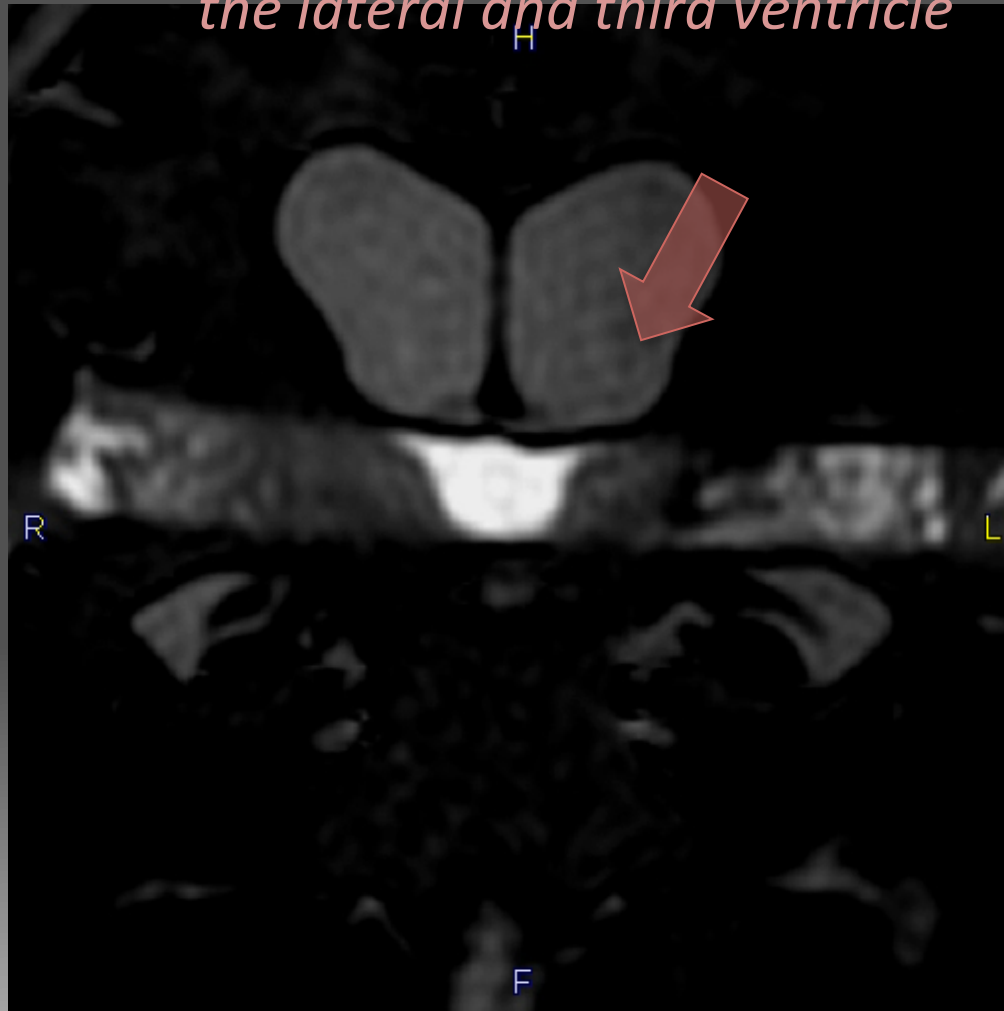
Male: 6

*Age : 67-87 Y/O
mean: 74 Y/O*

All patients underwent L-P shunt surgery

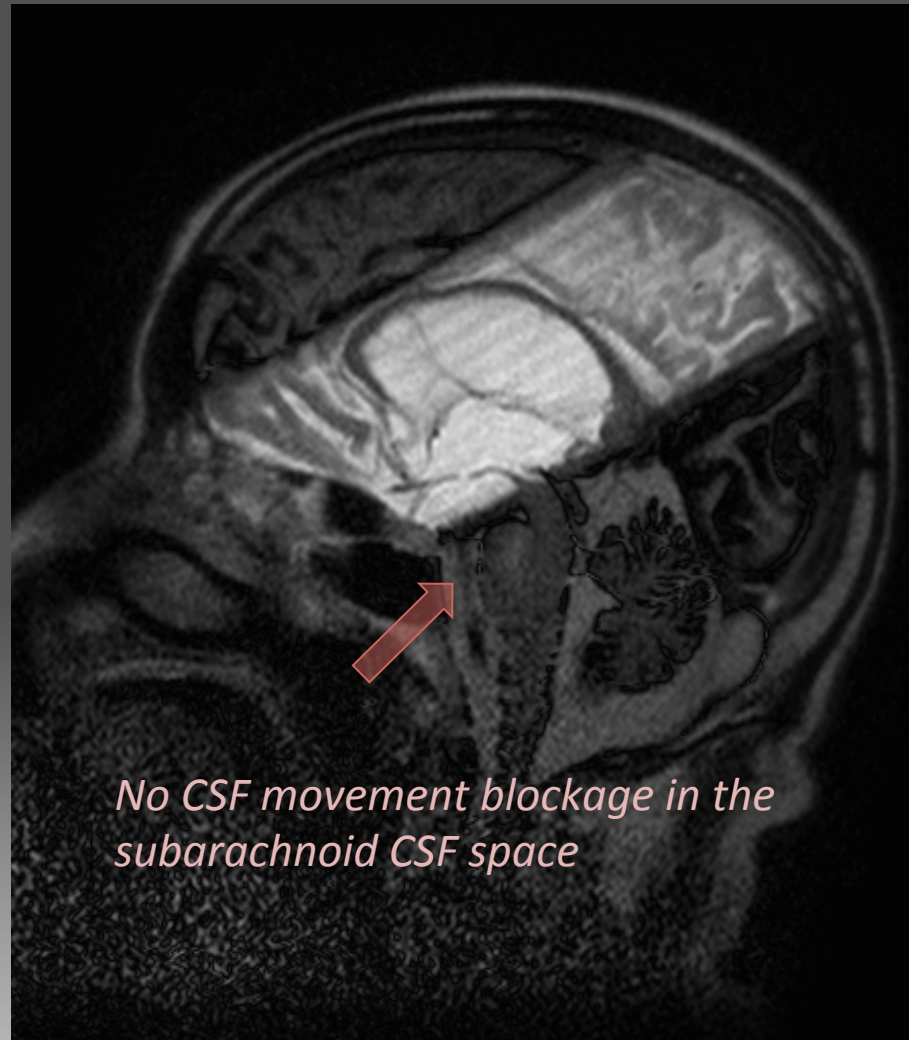
CSF dynamics in iNPH

*No CSF exchange between
the lateral and third ventricle*

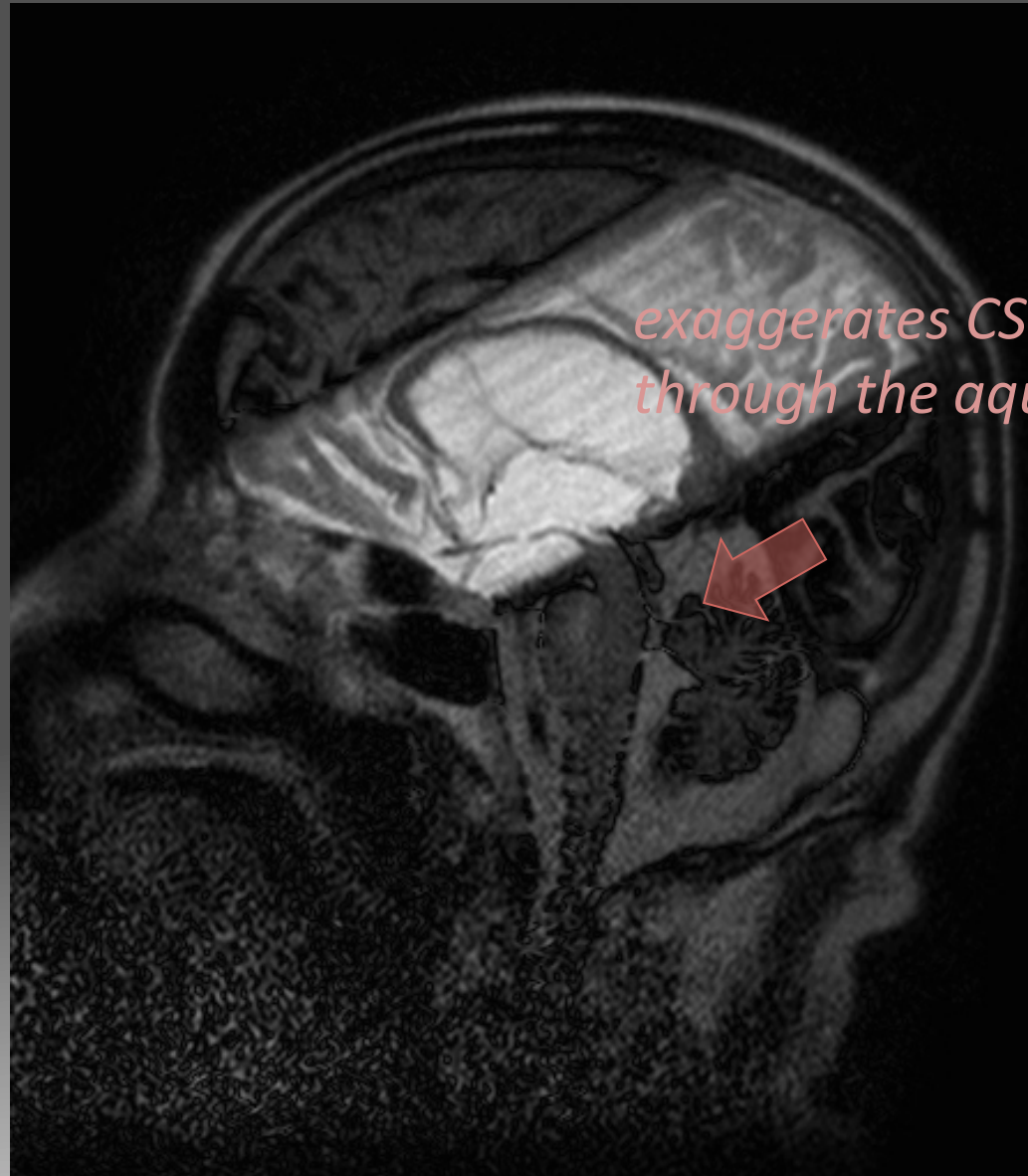


CSF dynamics in iNPH

*exaggerates CSF flow
through the aqueduct*

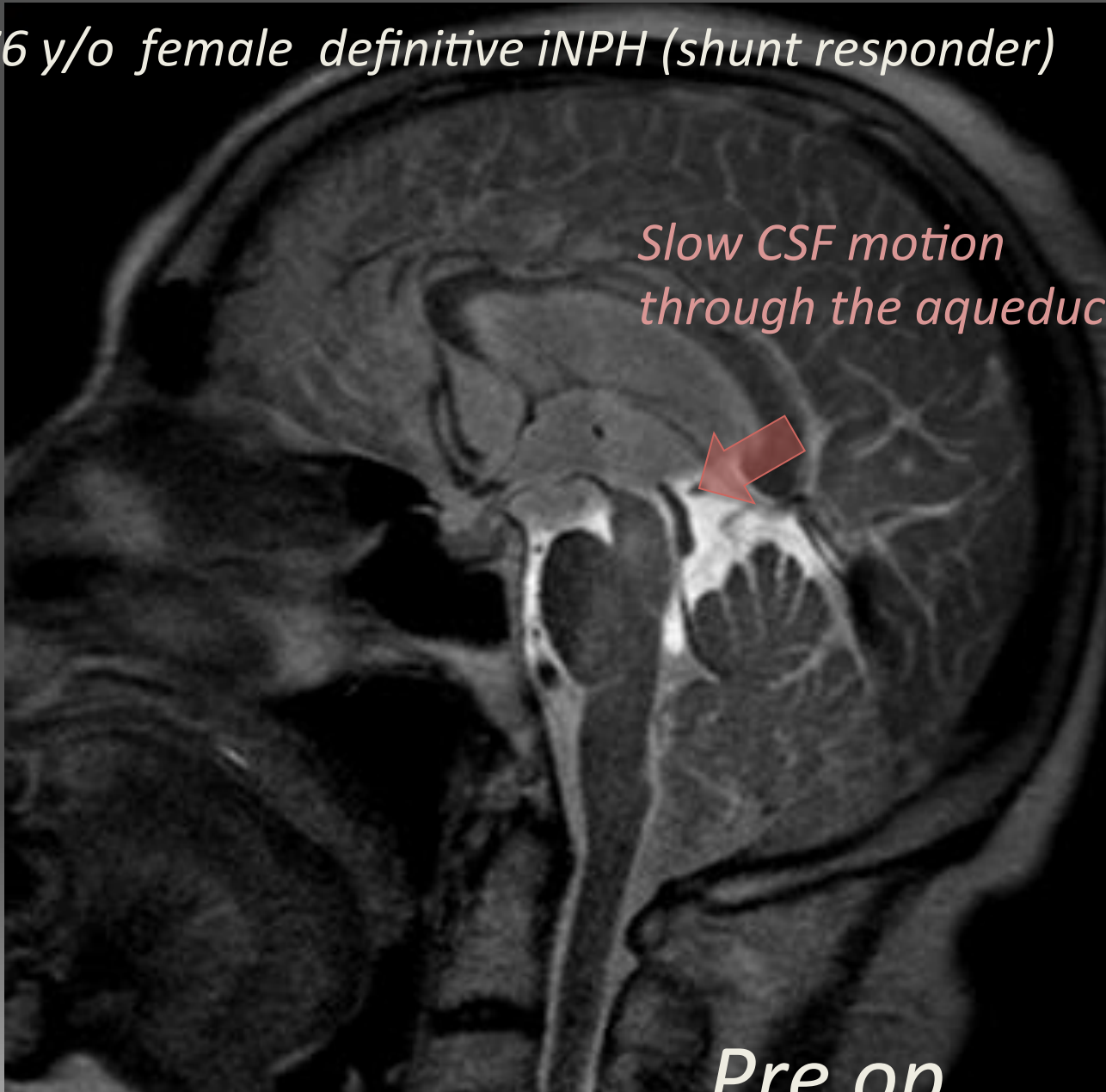


CSF dynamics in iNPH



76 y/o female definitive iNPH (shunt responder)

*Slow CSF motion
through the aqueduct*



Pre op.

CSF dynamics in iNPH

Aqueduct

Faster CSF movement through the aqueduct were seen approximately half of the cases.

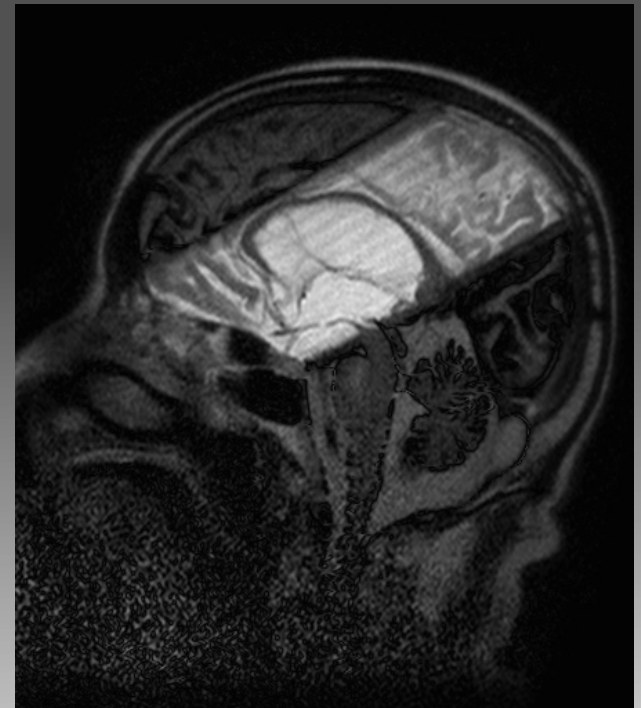
However, there were some cases showed very slow CSF movement through the aqueduct.

Differentiate iNPH from non-iNPH(brain atrophy) only by the CSF movement through aqueduct may be limited.

CSF dynamics in iNPH

Prepontine cistern

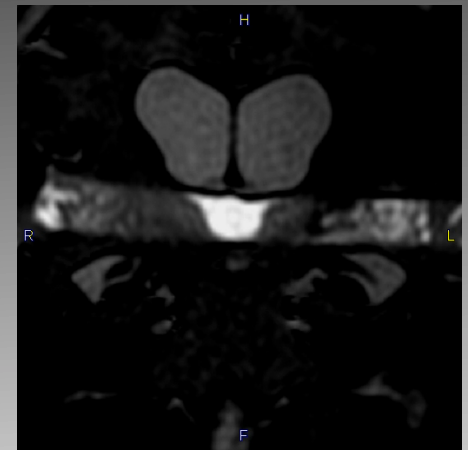
CSF movements in the prepontine cistern was not abnormal in majority of iNPH cases.



CSF dynamics in iNPH

Abnormal CSF reflux movement through the foraminae of Monro were often seen in iNPH.

None of the case has normal reflux movement through the foraminae of Monro in iNPH patient.



Conclusion

*CSF Hydrodynamics in NPH secondary to SAH
is different from idiopathic NPH*

NPH secondary to SAH :

CSF obstruction at prepontine subarachnoid space.

idiopathic NPH:

patent (no CSF obstruction) subarachnoid space

Conclusion

A non-invasive MRI time-SLIP technique demonstrated alteration of CSF Dynamics in NPH patients.