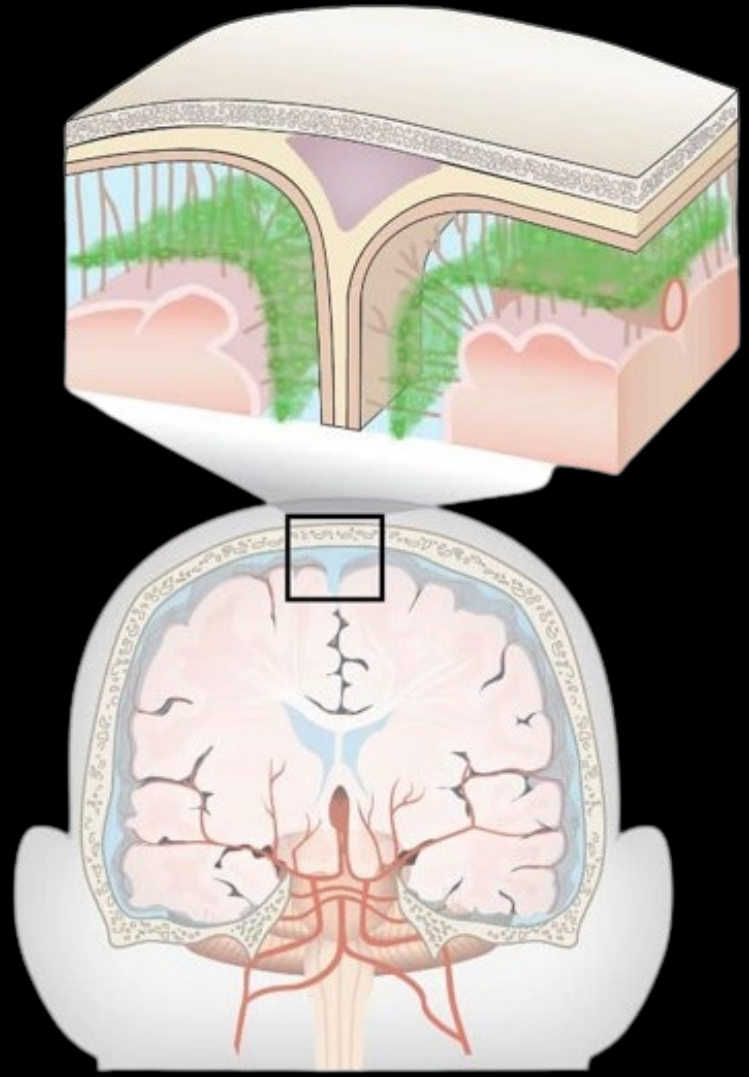

Compartmentalization of subarachnoid hemorrhage on CT suggesting first in-vivo visualization of the subarachnoid lymphatic-like membrane

(SLYM)

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Chris Heyn (Staff)
Pejman Maralani (Staff)

Disclosure of Conflict of Interest

- None

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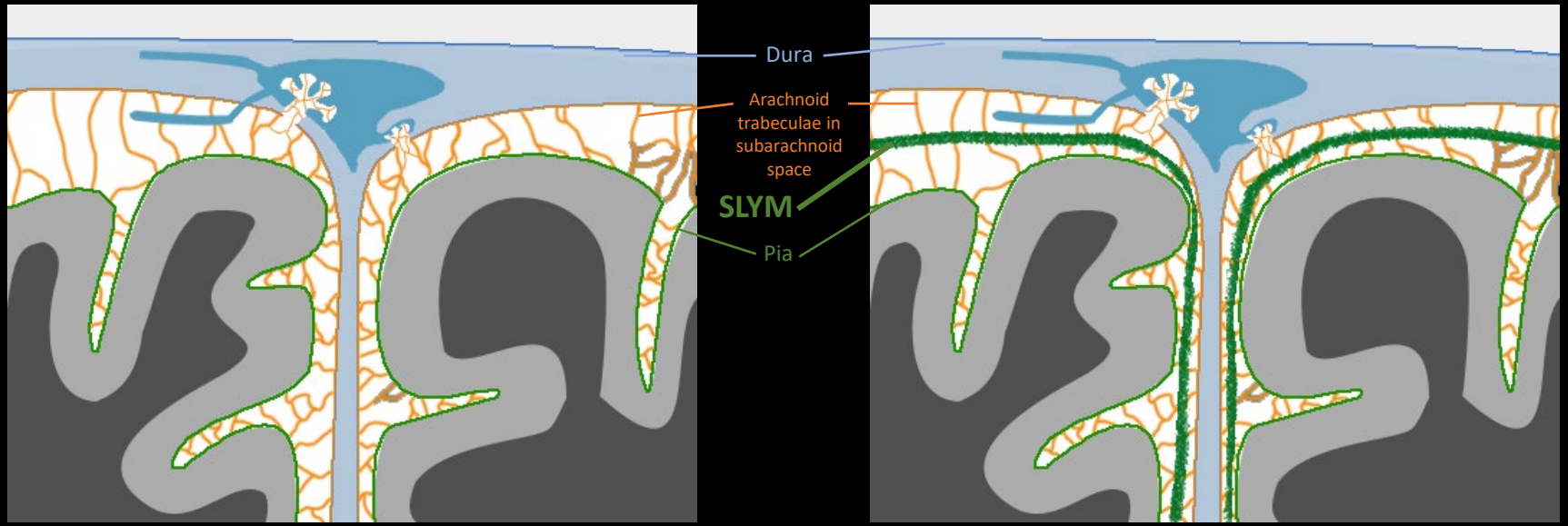

Historically, the subarachnoid space is a continuous cavity filled with cerebrospinal fluid.

Recently, a mesothelial layer was discovered dividing the subarachnoid space into two compartments.

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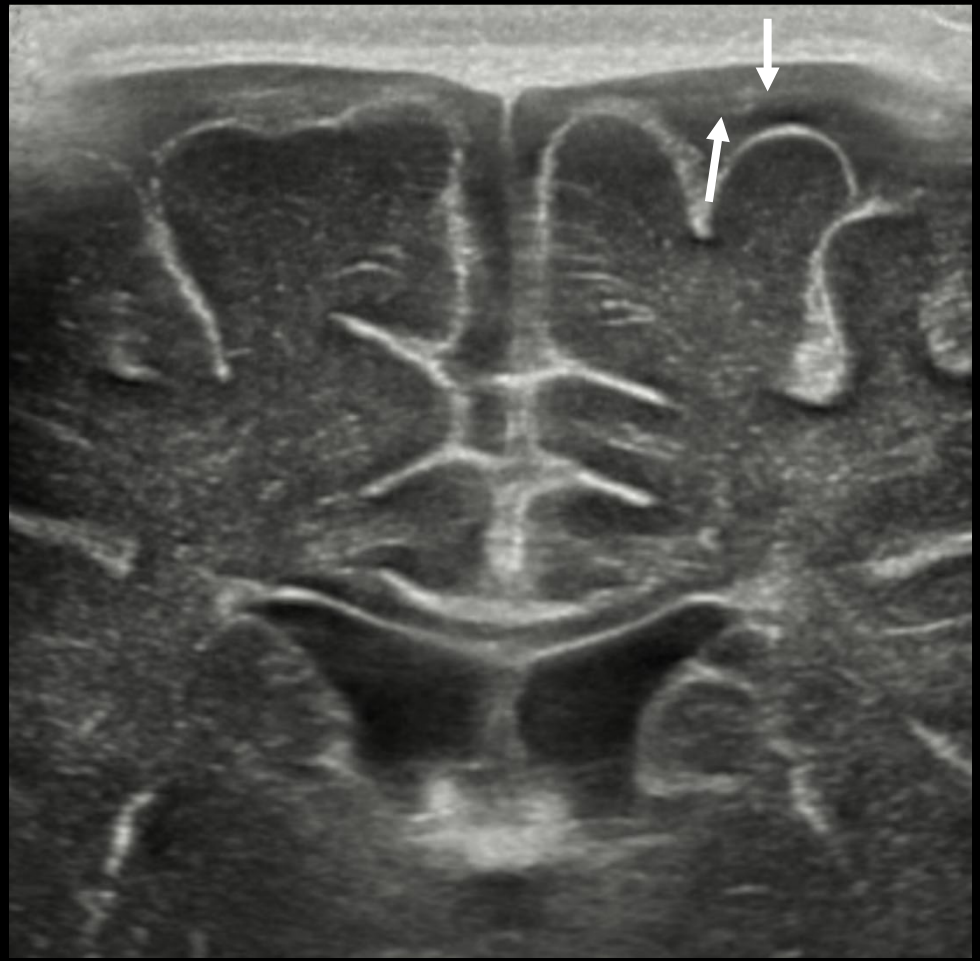

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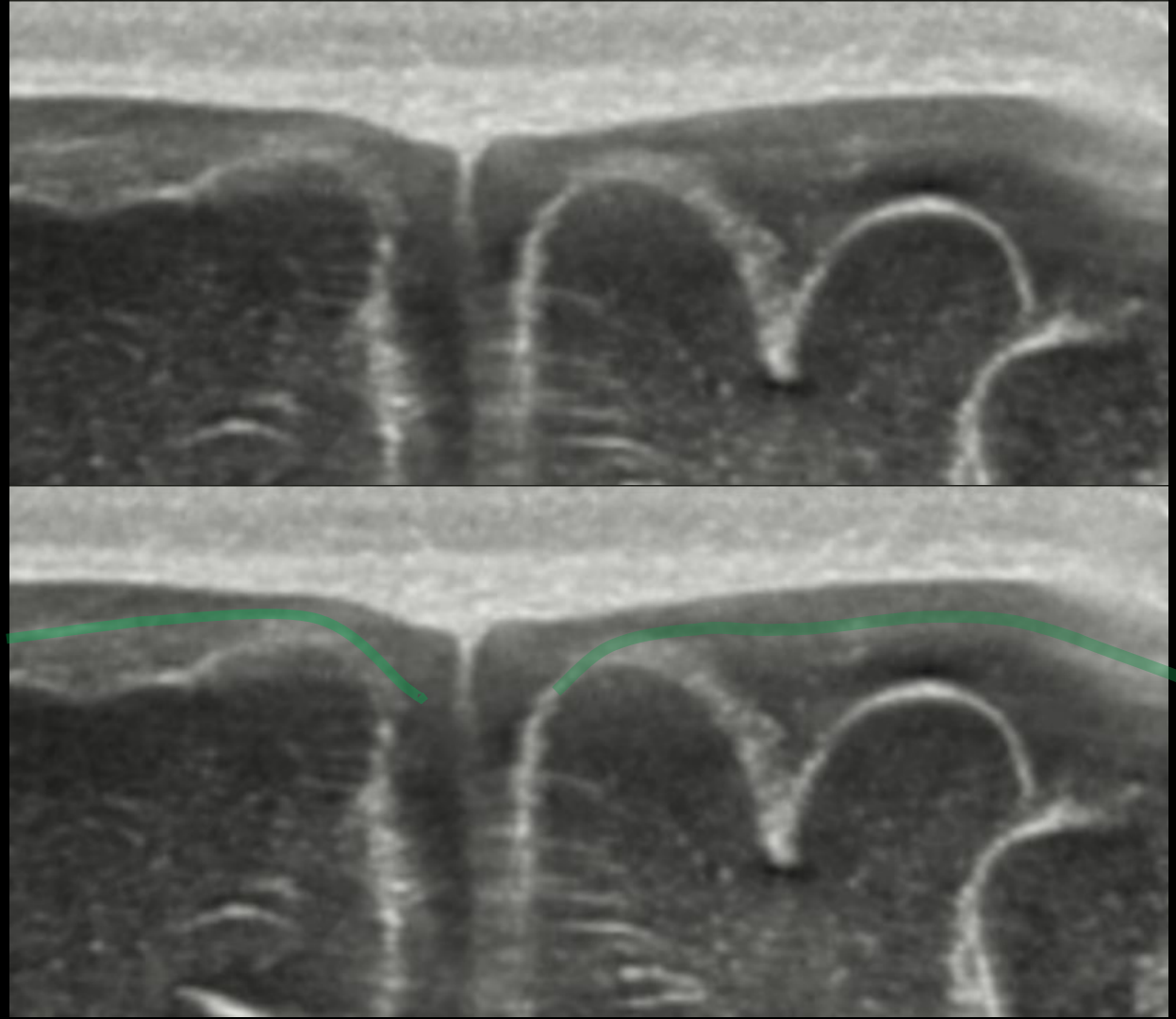

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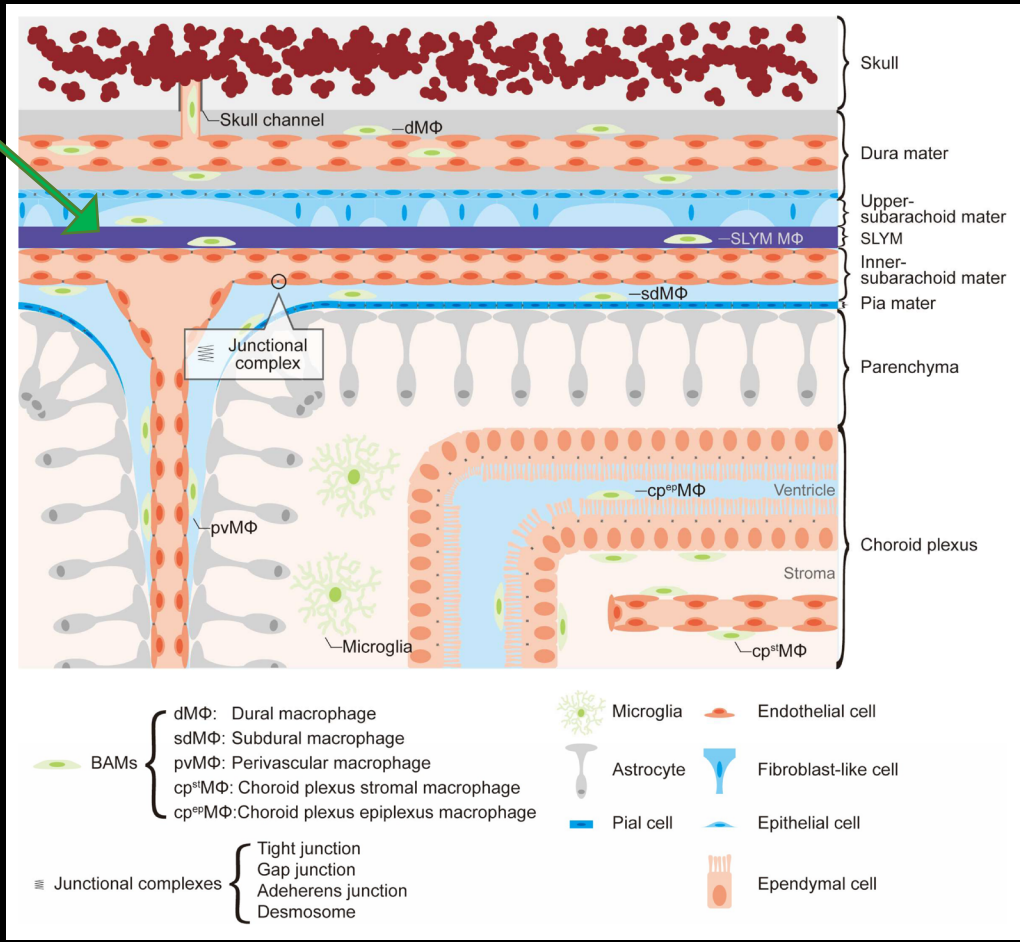
- Subarachnoid lymphatic-like membrane (SLYM) is a mesothelial layer dividing the subarachnoid space
- Composition
  - Mesothelium
  - Myeloid cells
  - Extracellular matrix
- Role
  - Barrier preventing the passage of molecules larger than 3 Kilodaltons
  - Innate immune function
  - (In mice, it regulates CSF flow analogous to human arachnoid granulations)



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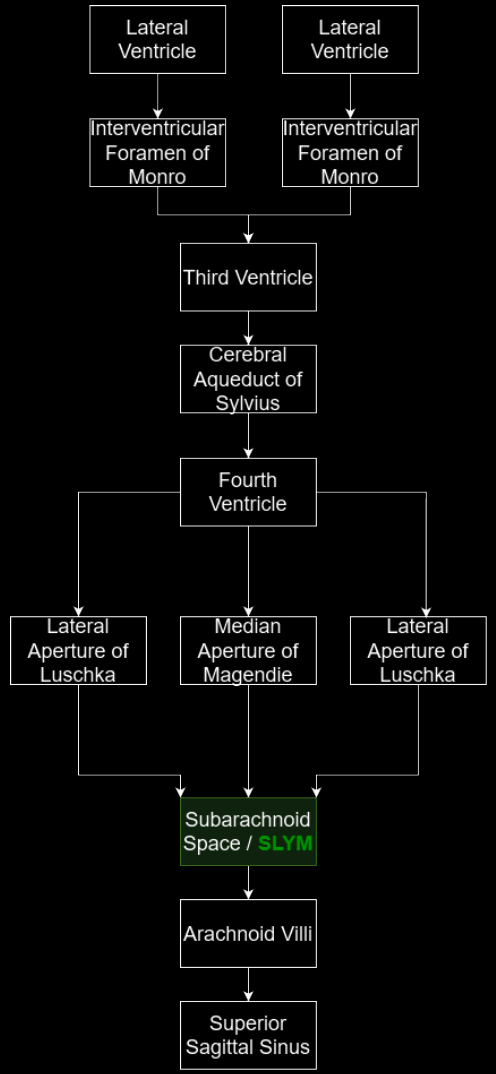
Circulation of CSF



Study Objective

Investigate radiological evidence for the presence of the SLYM

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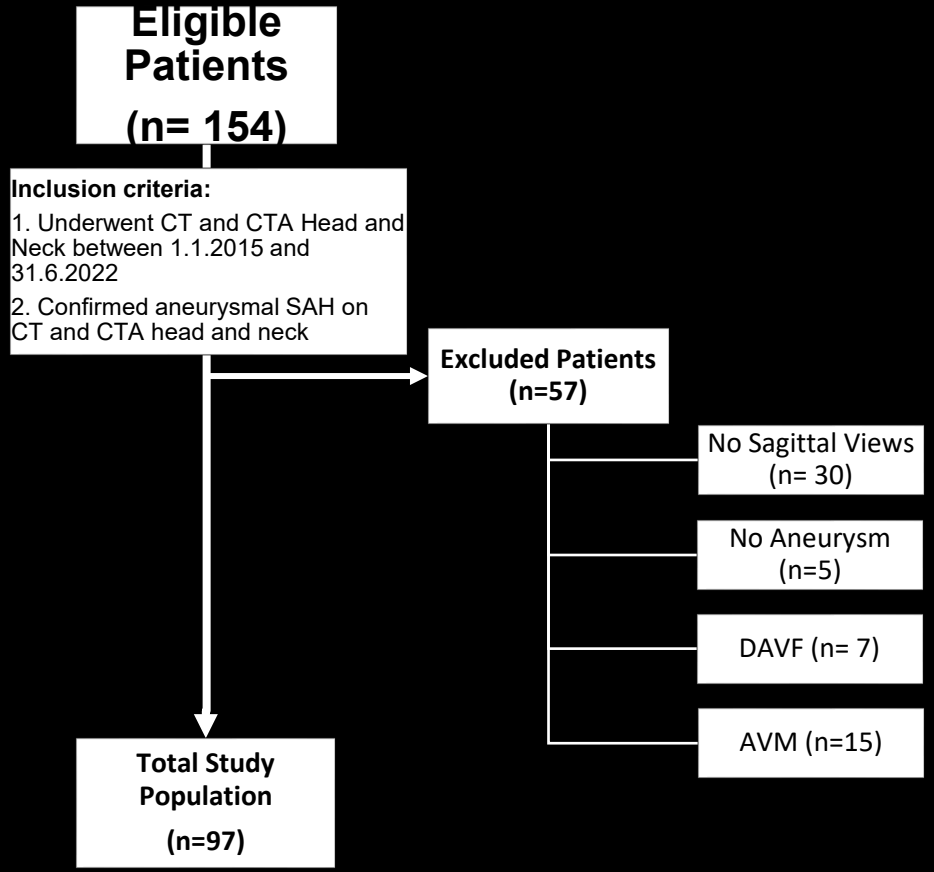
- Retrospective study of 97 patients analyzing CT / CTA Heads to assess SAH distribution and relationship to the modified Fisher scale (MFS).
- Statistical analysis using Chi-Square correlation test compared hemorrhage location and MFS scores. Statistical significance was set at p-value < .05.



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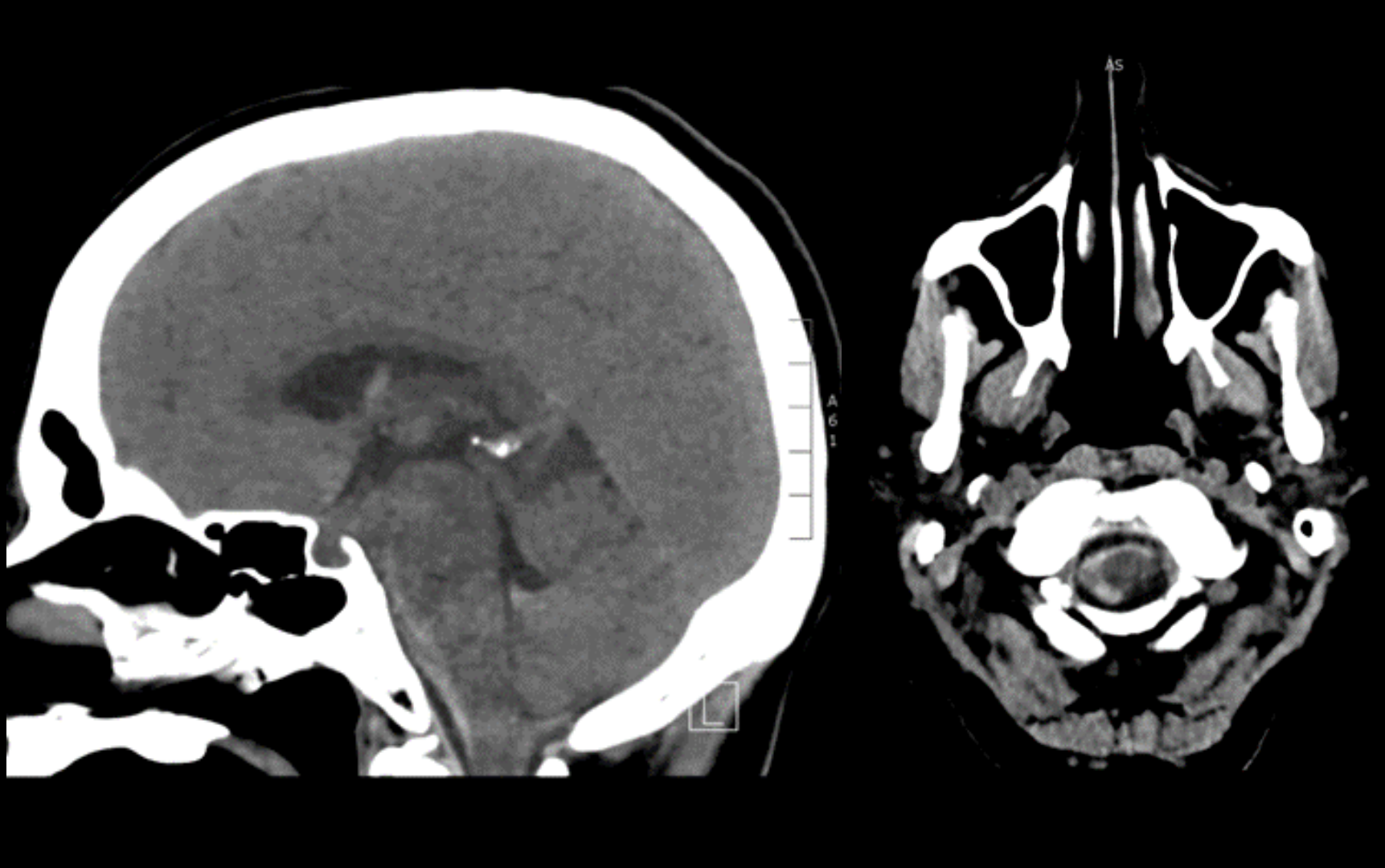

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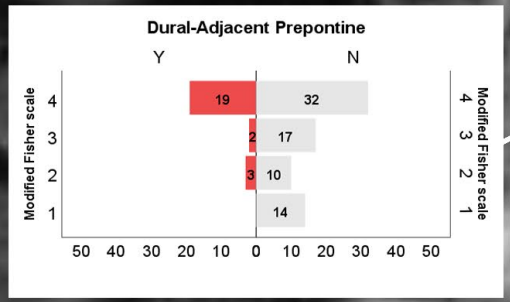
		Count	Percentage
Gender	Female	75	77.3%
	Male	22	22.7%

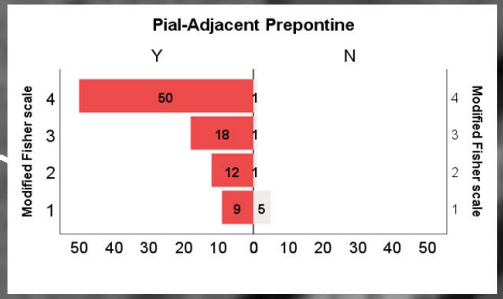
	Mean (± SD)	Min—Max
Age (years)	60.36 (± 12.13)	28—89

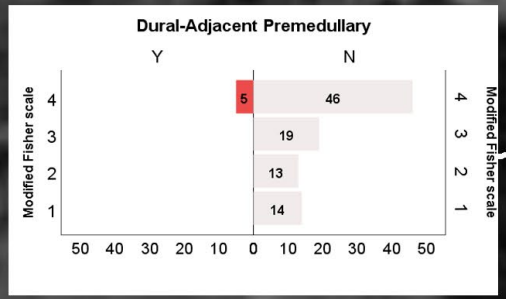
		Count	Percentage
WFNS Score			
	1	40	41.2%
	2	17	17.5%
	3	5	5.2%
	4	16	16.5%
	5	19	19.6%
Modified Fisher scale			
	1	14	14.4%
	2	13	13.4%
	3	19	19.6%
	4	51	52.6%

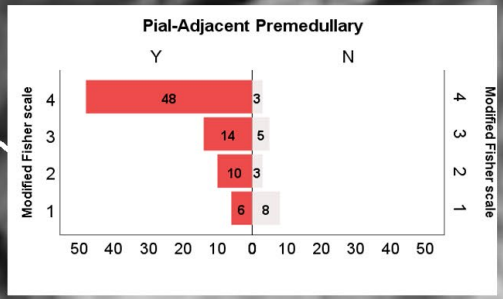
		Count	Percentage
Artery Involved			
	Anterior Cerebral Artery	1	1.0%
	Anterior Choroidal Artery	1	1.0%
	Anterior Communicating Artery	35	36.1%
	Anterior Inferior Cerebellar Artery	1	1.0%
	Basilar Artery	9	9.3%
	Internal Carotid Artery	8	8.2%
	Middle Cerebral Artery	10	10.3%
	Posterior Cerebral Artery	1	1.0%
	Posterior Communicating Artery	24	24.7%
	Posterior Inferior Cerebellar Artery	1	1.0%
	Vertebral Artery	6	6.2%
Aneurysm Type			
	Fusiform	7	7.2%
	Saccular	90	92.8%

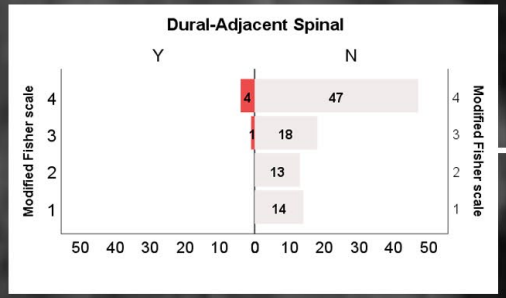
	Mean (± SD)	Min-Max
Aneurysm size (mm)	6.56 (± 4.7)	2—30

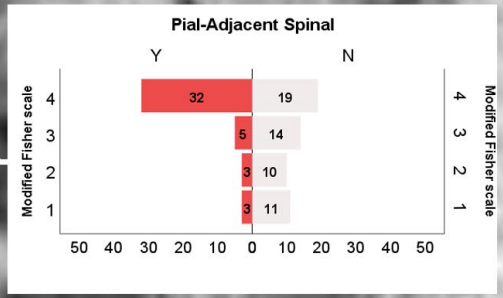












Suspected SLYM Location

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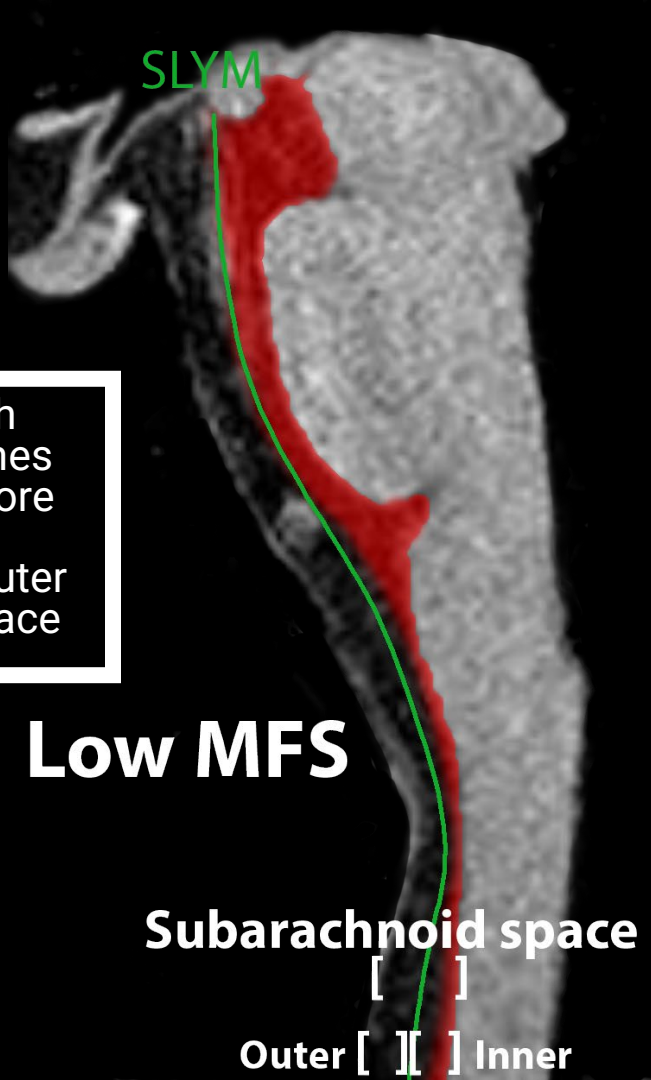
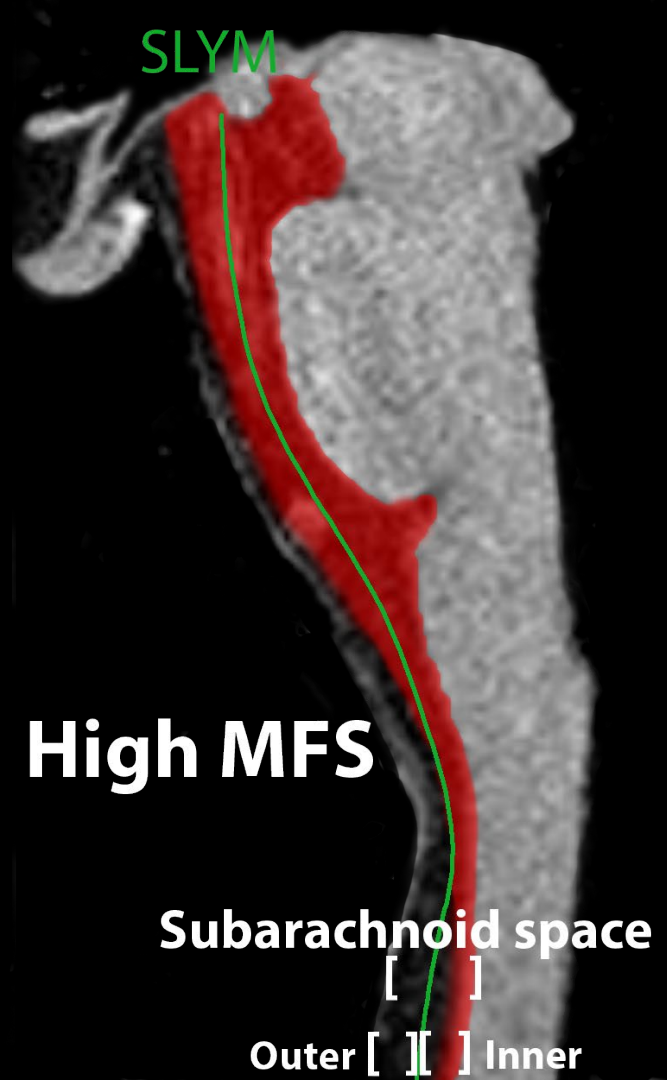
Patients with high MFS were 7.6 times (p-value < .05) more likely to have bleeding at the outer subarachnoid space





Low Modified Fisher Scores (1-2)

Juxta-Dural Prepontine

SAH in this location is not significantly associated with SAH in other locations at low MFS

Juxta-Dural Premedullary

No cases with subarachnoid hemorrhage in this location at low MFS

Juxta-Dural Perispinal

No cases with subarachnoid hemorrhage in this location at low MFS

		Juxta-Pial Prepontine		Chi-Square (p-value)
		Y	N	
Juxta-Pial Premedullary	Y	16	0	11.2 (0.001)
	N	5	6	

		Juxta-Pial Premedullary		
Juxta-Pial Prepontine	Y	16	5	11.2 (0.001)
	N	0	6	
Juxta-Pial Prespinal	Y	6	0	5.3 (0.021)
	N	10	11	

		Juxta-Pial Perispinal		
Juxta-Pial Premedullary	Y	6	10	5.3 (0.021)
	N	0	11	

High Modified Fisher Scores (3-4)

		Juxta-Dural Prepontine		Chi-Square (p-value)
		Y	N	
Juxta-Dural Premedullary	Y	5	0	10.3 (0.001)
	N	19	46	
Juxta-Dural Prespinal	Y	4	1	5.0 (0.025)
	N	20	45	

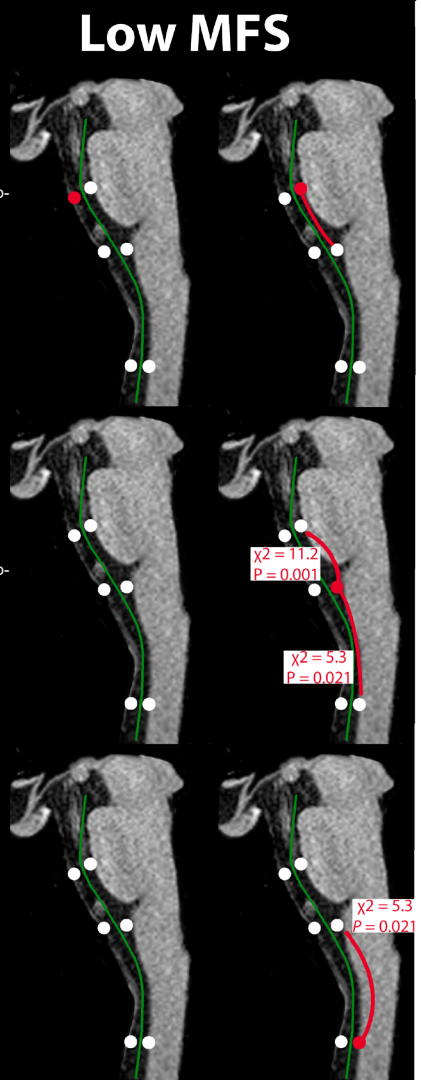
		Juxta-Dural Premedullary		
Juxta- Dural Prespinal	Y	3	2	22.7 (0.000)
	N	2	63	
Juxta-Dural Prepontine	Y	5	19	10.3 (0.001)
	N	0	46	
Juxta-Pial Prespinal	Y	5	32	4.8 (0.028)
	N	0	33	

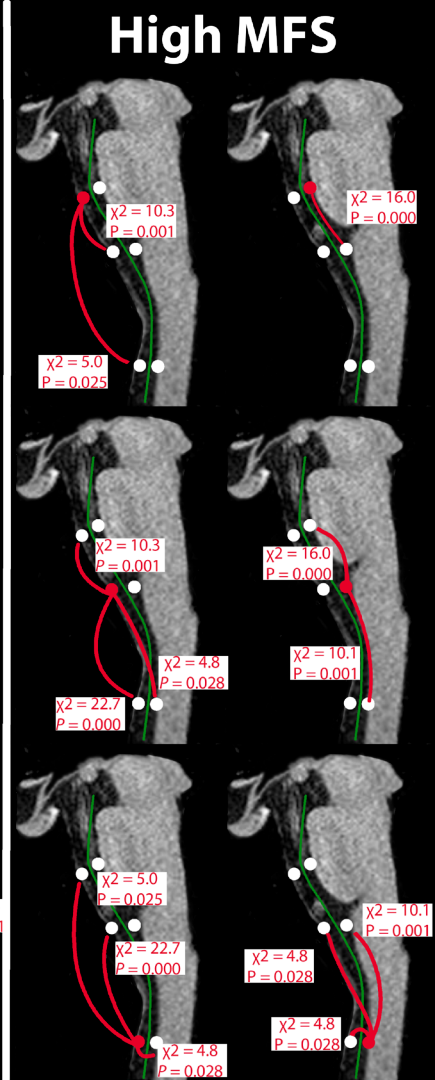
		Juxta-Dural Perispinal		
Juxta-Dural Premedullary	Y	3	2	22.7 (0.000)
	N	2	63	
Juxta-Dural Prepontine	Y	4	20	5.0 (0.025)
	N	1	45	
Juxta-Pial Prespinal	Y	5	32	4.8 (0.028)
	N	0	33	

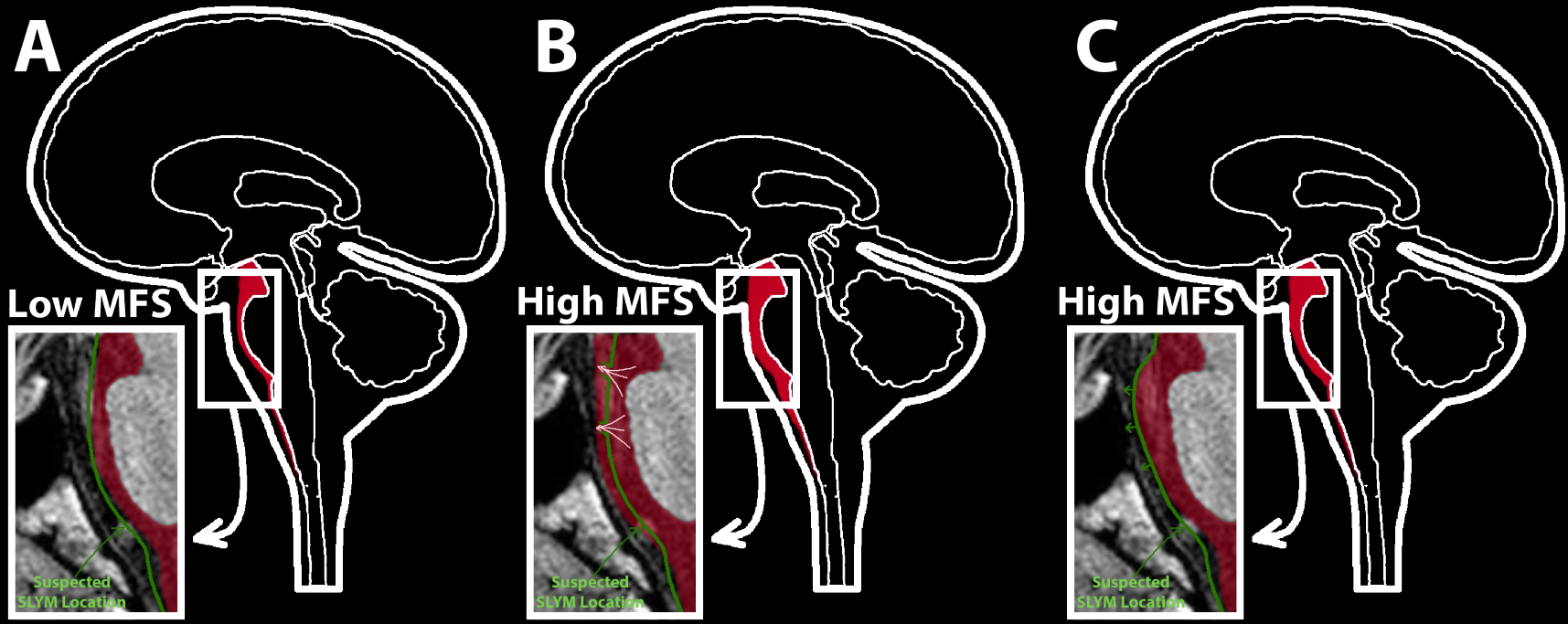
		Juxta-Pial Prepontine		Chi-Square (p-value)
		Y	N	
Juxta-Pial Premedullary	Y	62	0	16.0 (0.000)
	N	6	2	

		Juxta-Pial Premedullary		
Juxta-Pial Prepontine	Y	62	6	16.0 (0.000)
	N	0	2	
Juxta-Pial Prespinal	Y	37	0	10.1 (0.001)
	N	25	8	

		Juxta-Pial Perispinal		
Juxta-Pial Premedullary	Y	37	25	10.1 (0.001)
	N	0	8	
Juxta-Dural Prespinal	Y	5	0	4.8 (0.028)
	N	32	33	
Juxta-Dural Premedullary	Y	5	0	4.8 (0.028)
	N	32	33	







SAH distributes in the deep or pial-adjacent subarachnoid space

SAH distributes superficially and deep due to SLYM rupture?

SAH distributes superficially and deep due to SLYM displacement?

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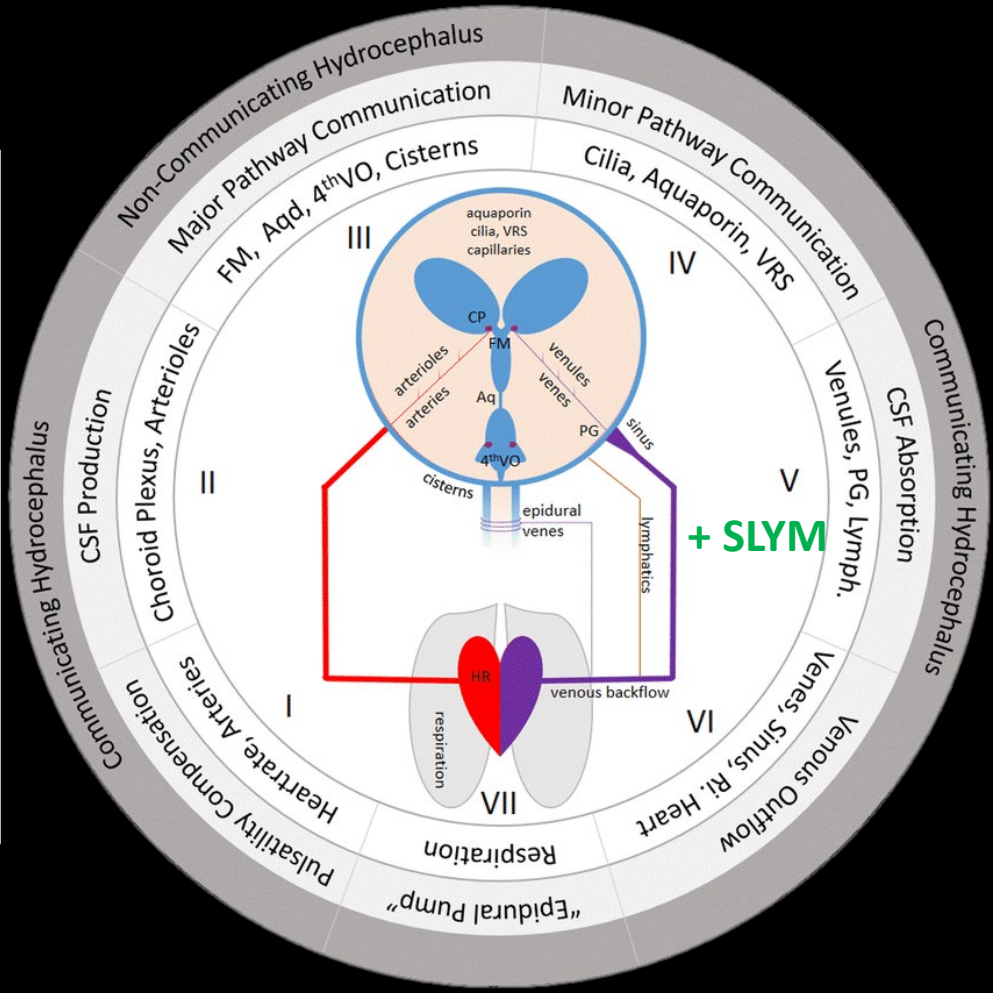
- Study suggests a link between bleeding severity and blood distribution
- Blood distribution patterns potentially influenced by the SLYM's location, especially in mild cases where blood functions as an internal contrast agent
- Implications of identifying SLYM:
  - Understand pathophysiology of communicating hydrocephalus and avoiding potential misdiagnosis
  - Distribution of SAH could help differentiate aneurysmal vs non-aneurysmal etiology



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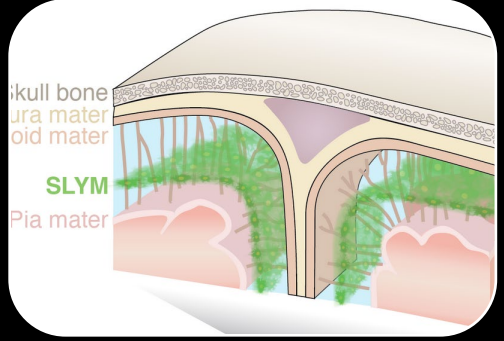
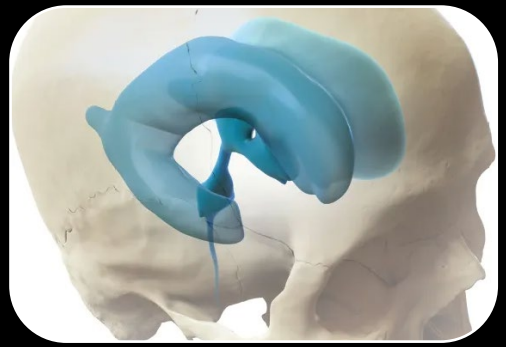


Subarachnoid lymphatic-like membrane (SLYM), divides the subarachnoid space into two compartments.

Imaging has potential for understanding and investigating the SLYM

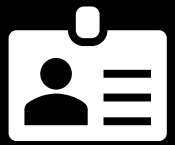
Mild aSAH patterns might reveal SLYM location due to blood acting as an internal contrast.



Understanding the SLYM could impact our understanding of various neurological disorders

Thank You!
Any Questions?

Do you need medical illustrations for a research project? ↓↓



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