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CFD Analysis for Cerebral Aneurysms: WSS of the Aneurysmal Dome in Contact with Perianeurysmal Environment

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Starting Now

Lecturers report no conflict of interest concerning the materials or methods used in this study.

Hypothesis

Perianeurysmal environment (PAE) in contact with the aneurysmal dome (PAEC) can be an extrinsic factor that may affect the wall shear stress (WSS) induced by the intrinsic factor of the intra-aneurysmal hemodynamics.

Methods

Cases of Unruptured Aneurysms:

① with PAEC group (n=18)

② without PAEC group (n=16)

PAEC Imaging:

3D multifusion image of 3D ASL-MRA & FSE-MRC

CFD Analysis:

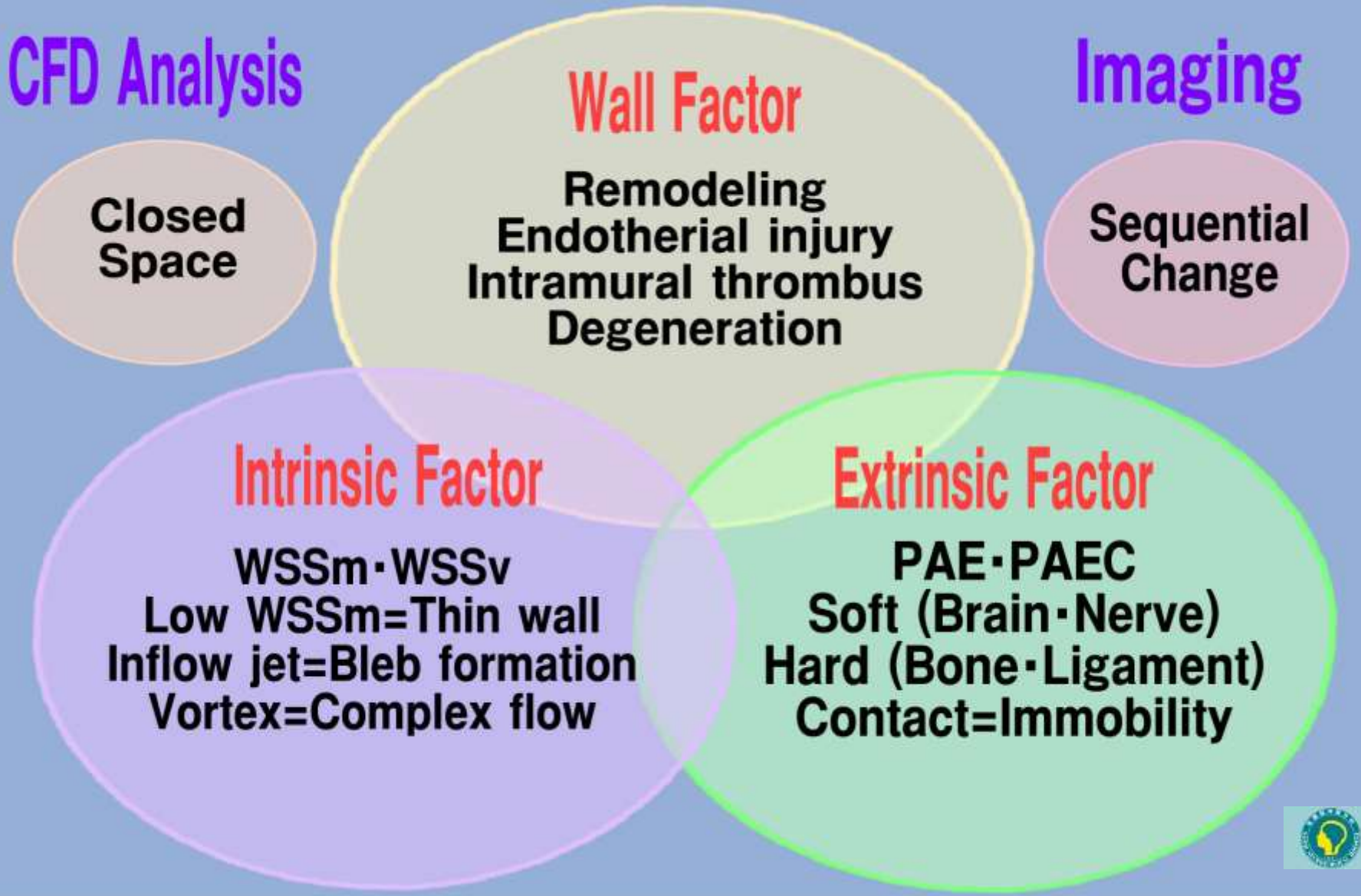
① WSSm (magnitude): WSSm-parent, WSSm-dome, WSSm-PAEC, WSSm-hetero

② WSSv (vector): WSSvV (vector variations)

③ SL: Streamline

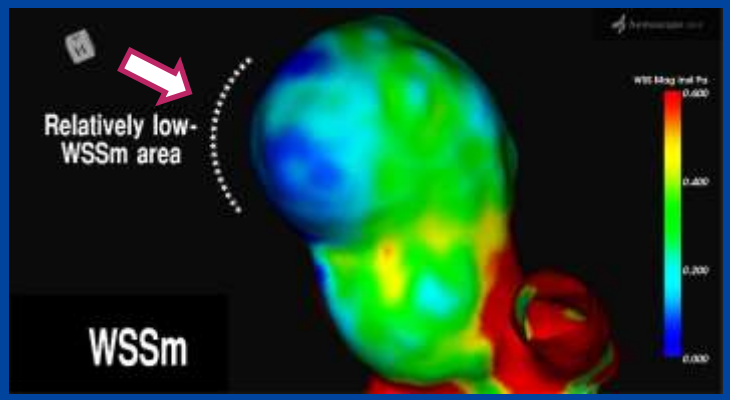
④ WP: Wall pressure

Intracranial Environment of Cerebral Aneurysm



Who knows real result with just intrinsic CFD?

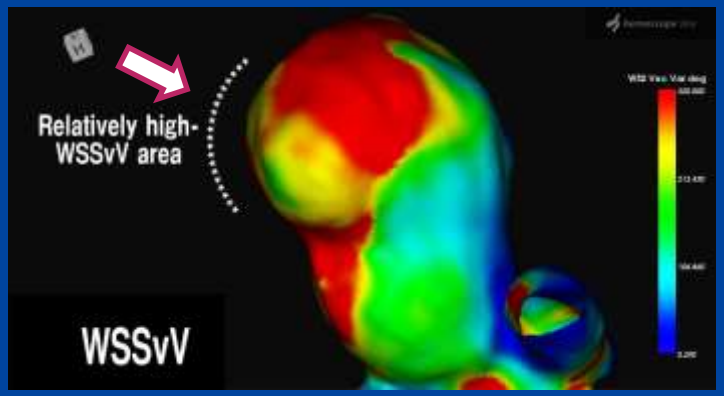
WSSm Animation:
AComA Aneurysm



WSSm

Who knows real result with just intrinsic CFD?

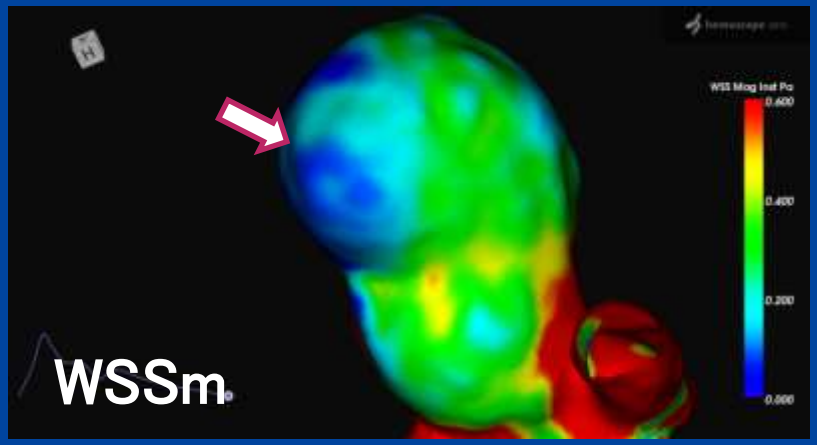
WSSv Animation:
AComA Aneurysm

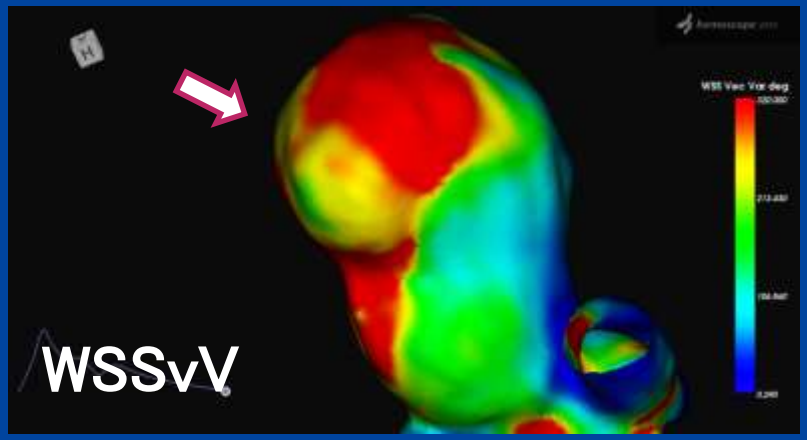


WSSvV

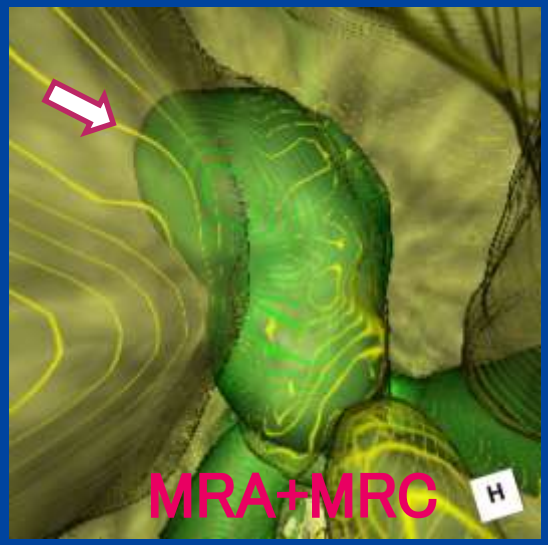
We know why with intrinsic & extrinsic factors

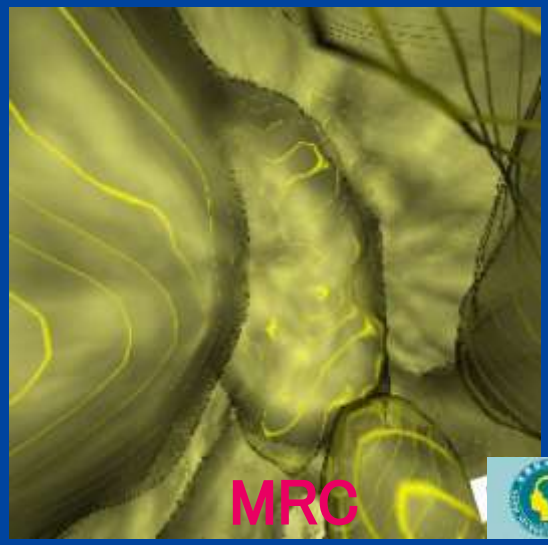
Intrinsic factor: CFD Analysis





Extrinsic factor: PAEC Imaging

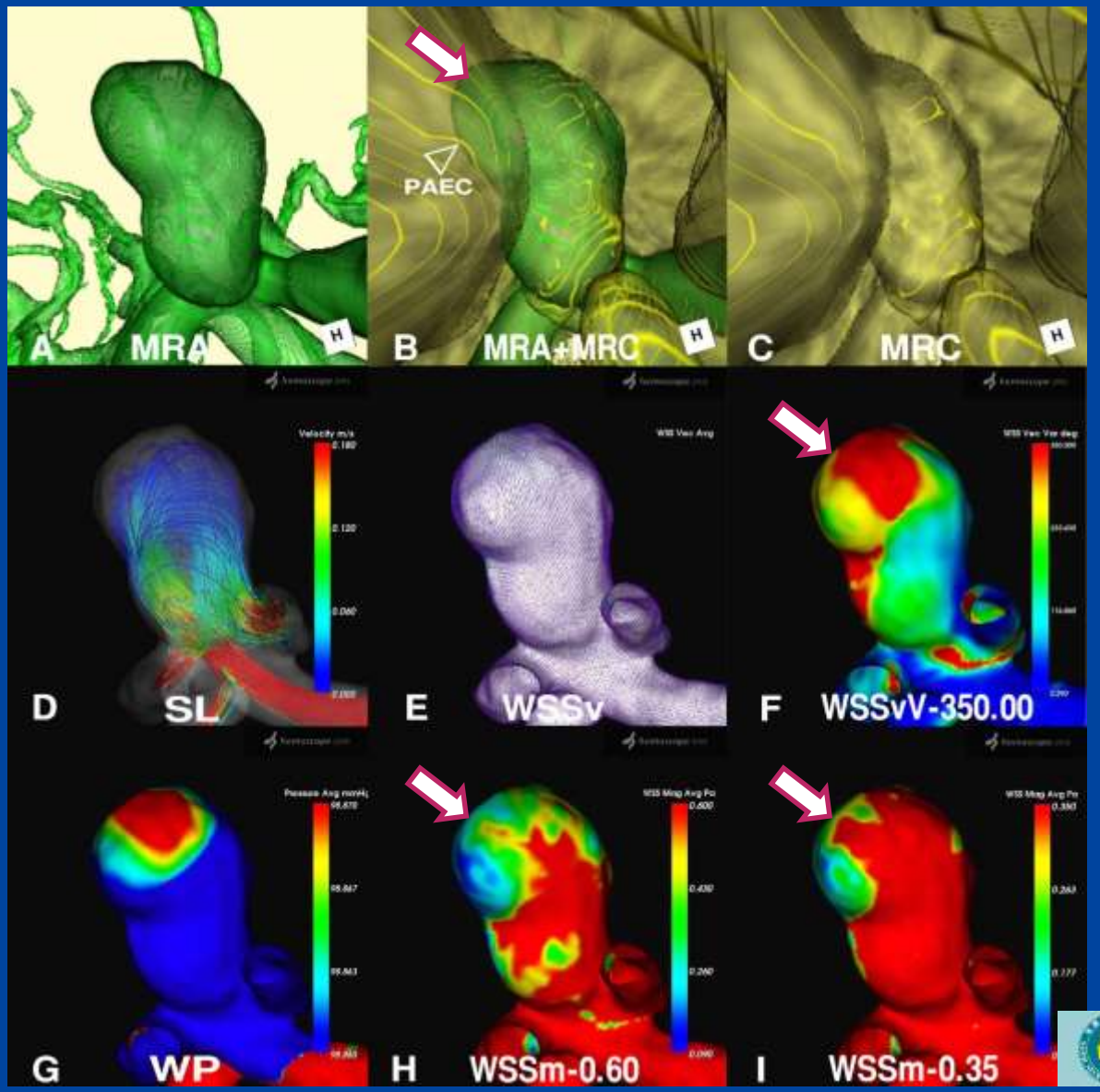




Extrinsic & intrinsic factors: AComA An

Extrinsic factor:
PAEC Imaging
With PAEC

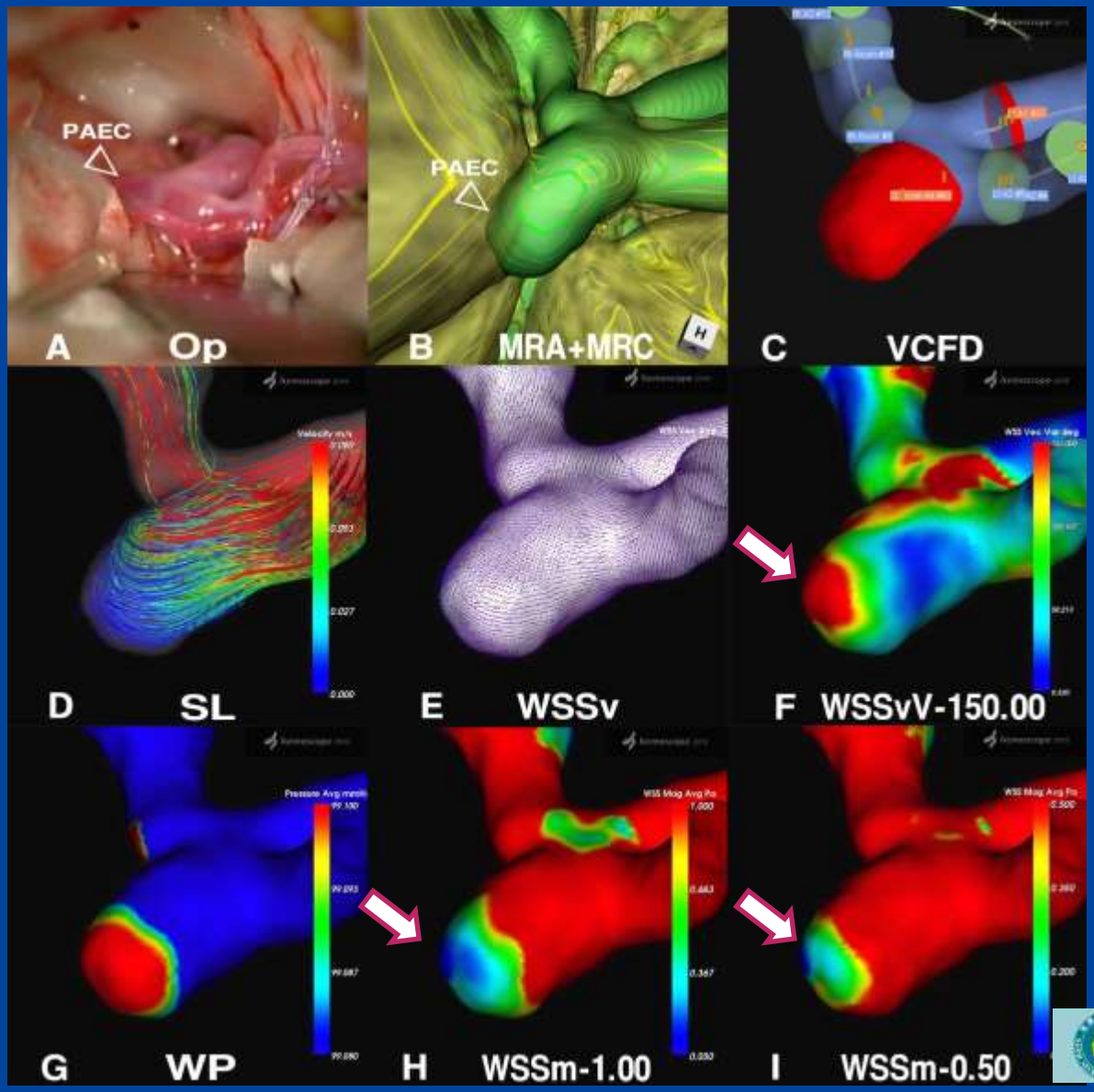
Intrinsic factor:
CFD Analysis
With PAEC



Extrinsic & intrinsic factors: AComA An

Extrinsic factor:
PAEC Imaging
With PAEC

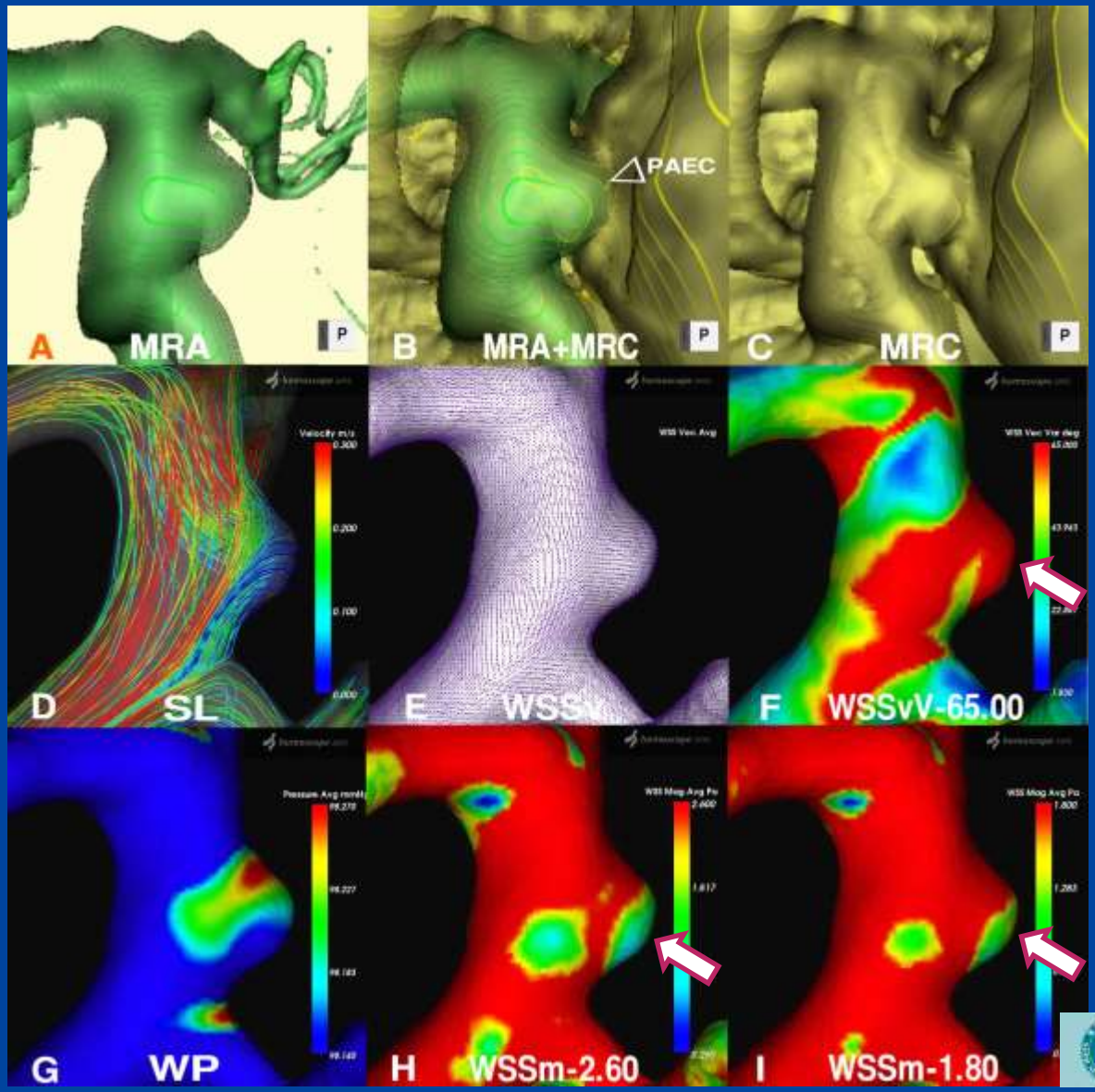
Intrinsic factor:
CFD Analysis
With PAEC



Extrinsic & intrinsic factors: AChorA An

Extrinsic factor:
PAEC Imaging
With PAEC

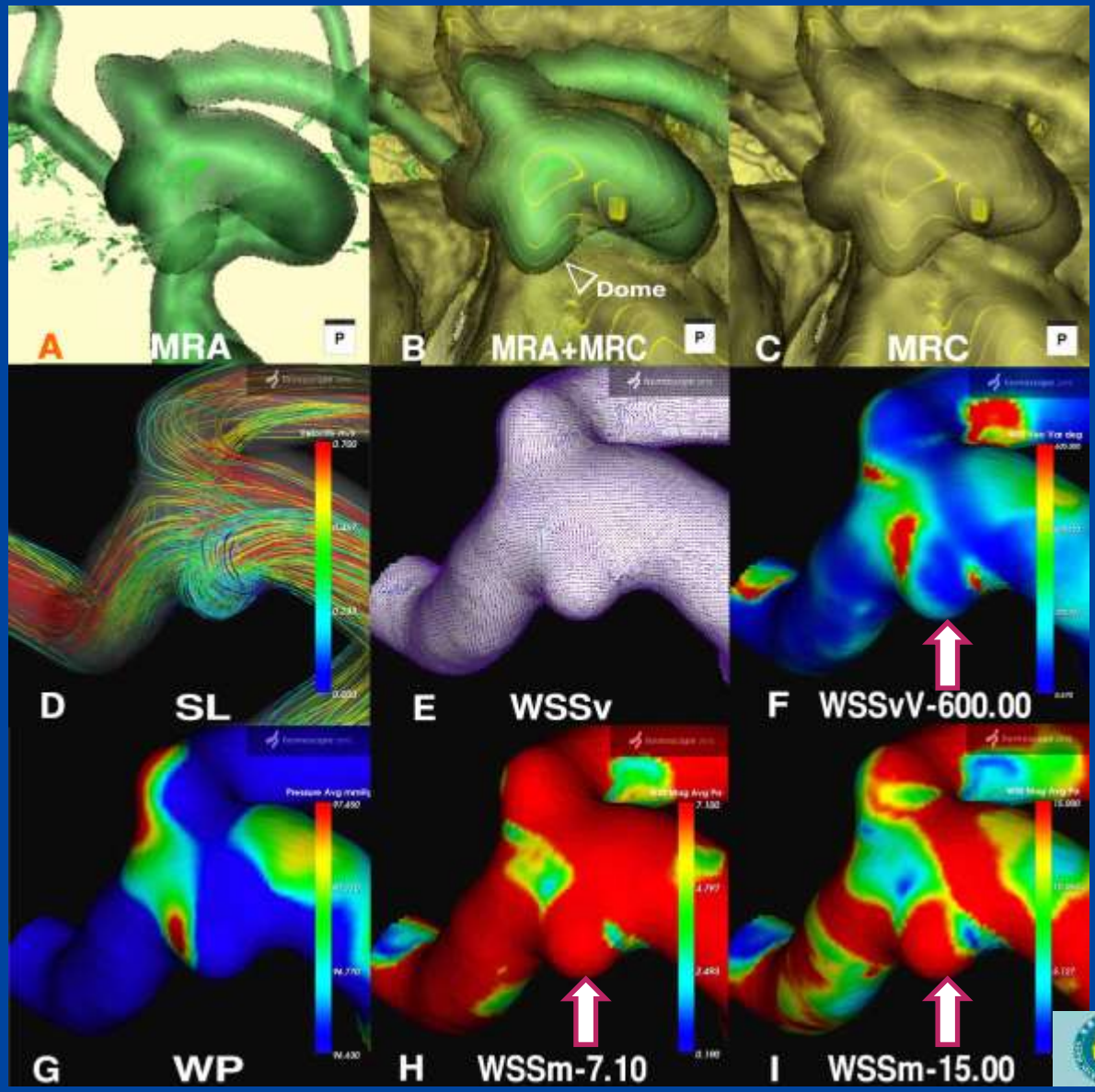
Intrinsic factor:
CFD Analysis
With PAEC



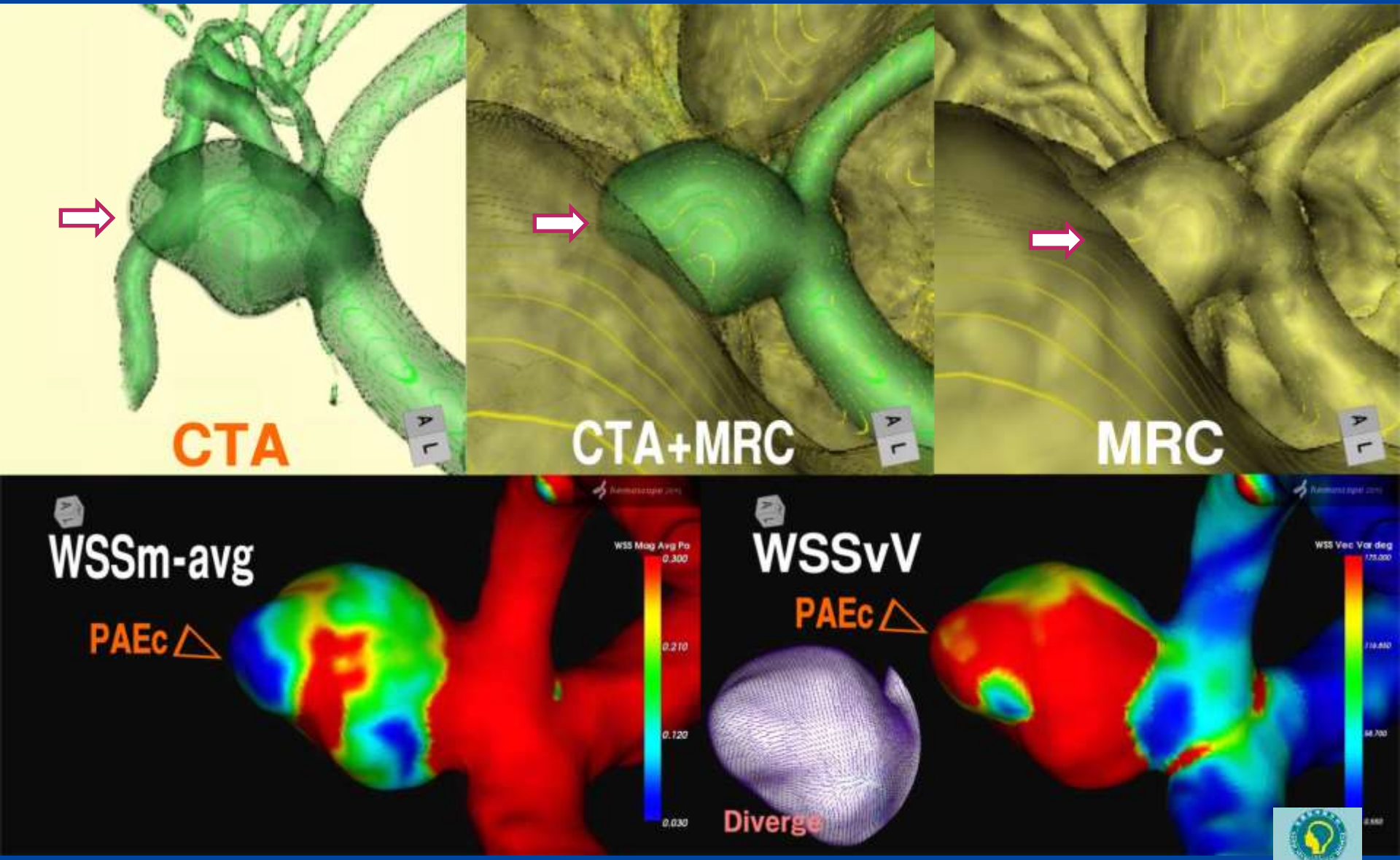
Extrinsic & intrinsic factors: AChorA An

Extrinsic factor:
PAEC Imaging
Without PAEC

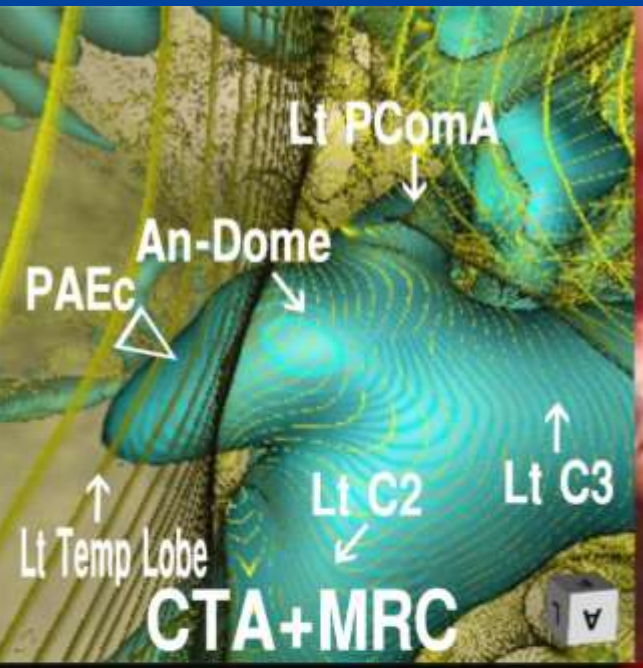
Intrinsic factor:
CFD Analysis
Without PAEC

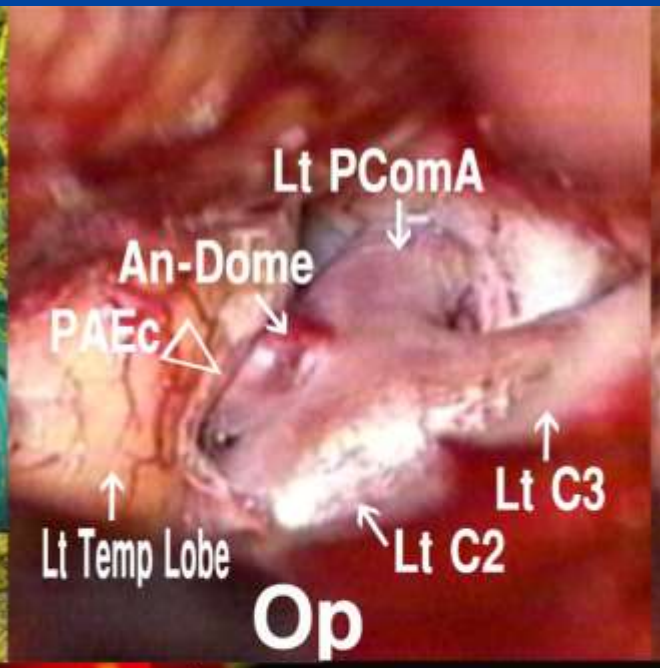


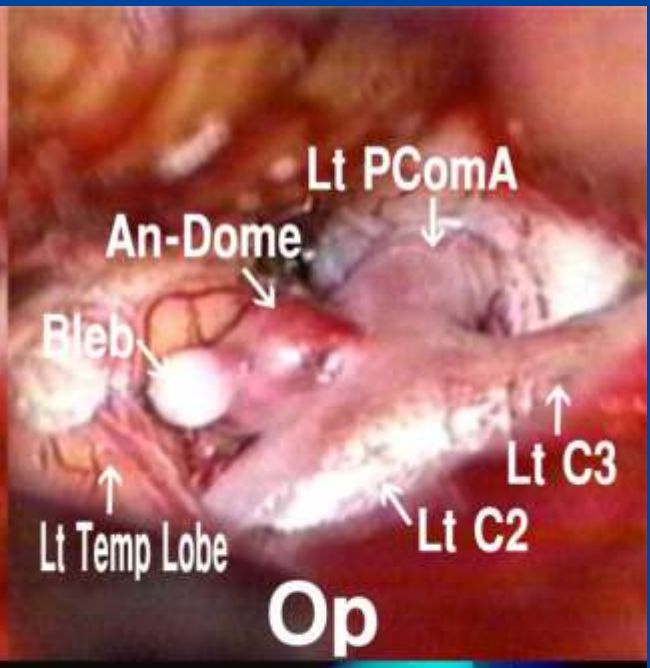
Extrinsic & intrinsic factors: MCA An

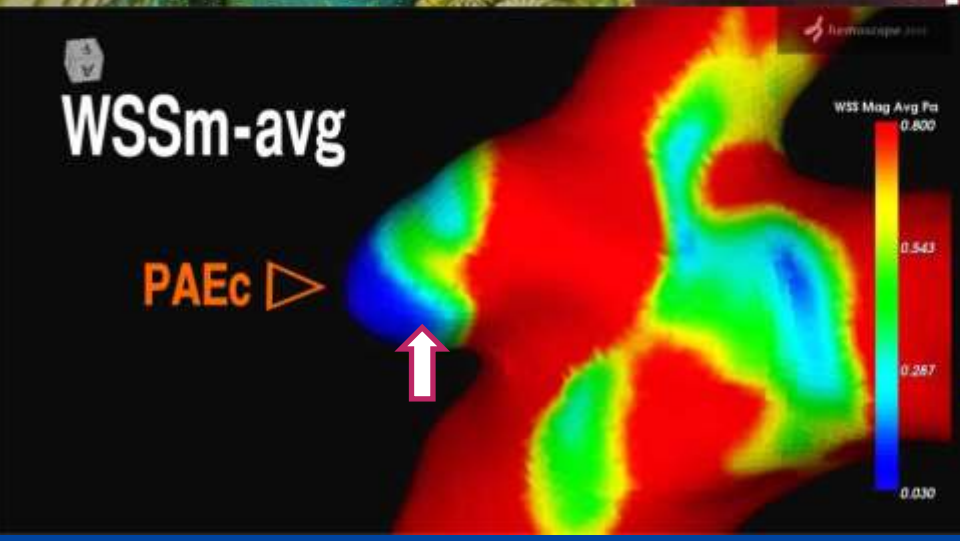


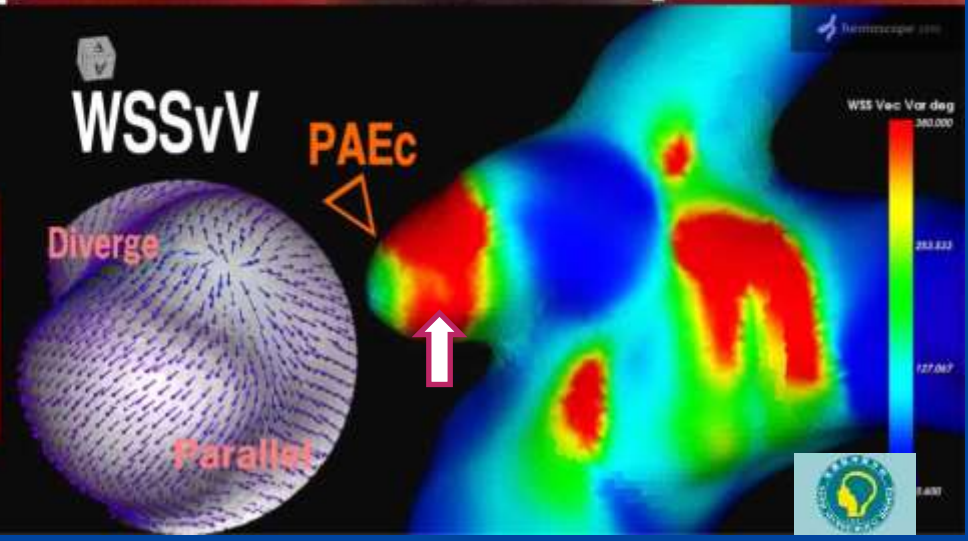
Extrinsic & intrinsic factors: IC-PC An



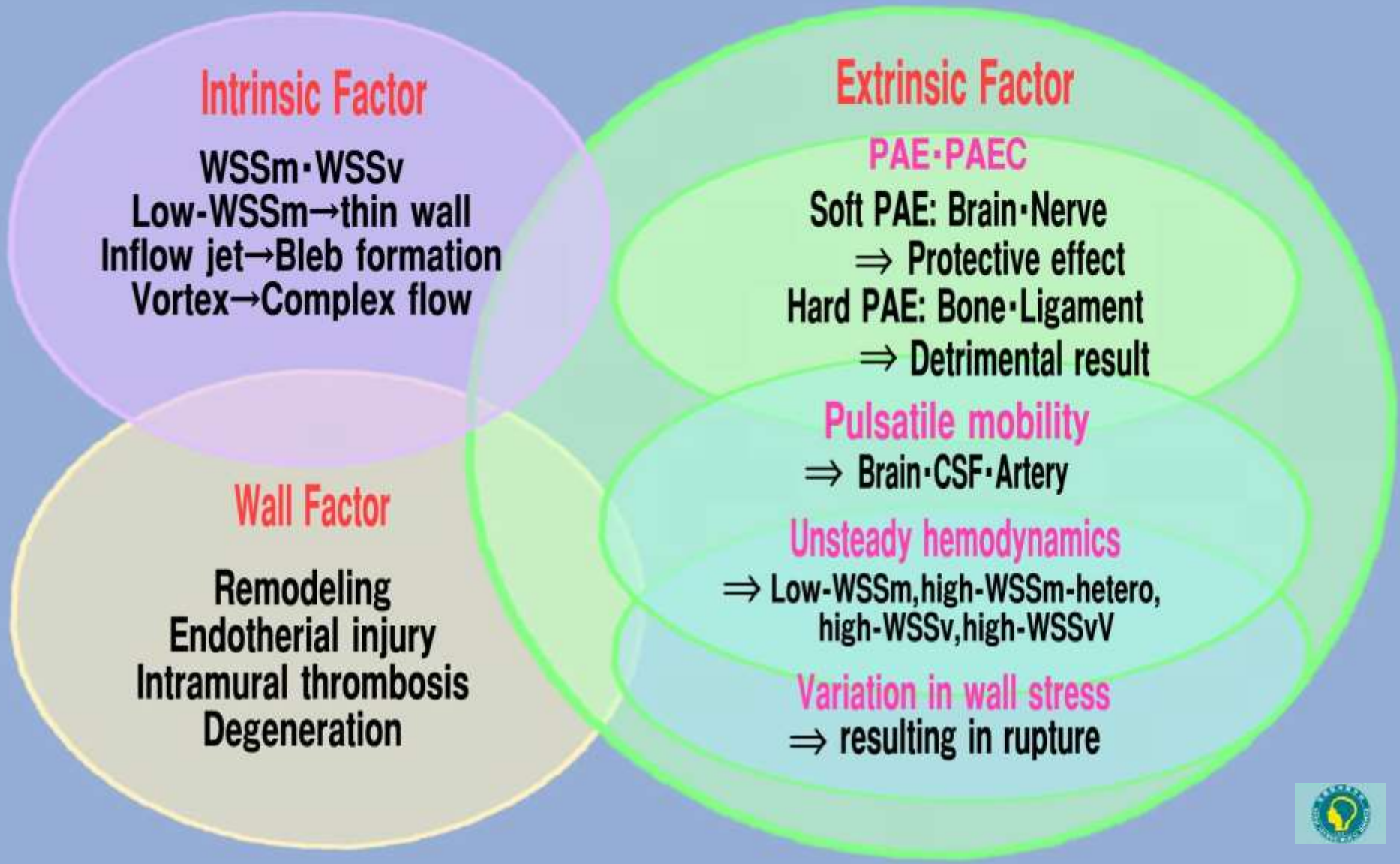








Interaction with Intrinsic & Extrinsic factors



Conclusions

① Areas of relatively low WSSm, increased WSSm-hetero, frequent WSSv and high WSSvV of the aneurysmal dome may indicate the existence and location of PAEC.

②The extrinsic factors affected by the PAEC, interacted with intrinsic factors induced by intra-aneurysmal hemodynamics.

③ PAEC may provide an additional factor in the consideration of the natural history of a cerebral aneurysm in rupture.

Thank you for your kind attention !

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