CONTROVERSES ET ACTUALITES EN CHIRURGIE VASCULAIRE
CONTROVERSIES & UPDATES IN VASCULAR SURGERY
JANUARY 23-25 2020
MARRIOTT RIVE GAUCHE & CONFERENCE CENTER | PARIS | FRANCE
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Wall shear stress in the afferent arteries of a superficial arteriovenous malformation is an early and reliable marker of progression.

Imane El Sanharawi, [1,2,3] *
Stéphanie Lenck, [1,4]
Didier Salvan, [1,5]
Olivier Bailliart, [1,3]
Nathalie Kubis, [1,2,3]
Annouk Bisdorff-Bresson, [1,4]
Philippe Bonnin [1,2,3]

CACVS Paris
January 25th, 2020

No disclosure

[1] Université de Paris, Paris France, F-75010, Paris, France ;
[2] CART, INSERM UMR965, Hôpital Lariboisière, ;
[3] AP-HP, Hôpital Lariboisière, Physiologie Clinique ;
[4] AP-HP, Hôpital Lariboisière, Neuroradiologie, Centre constitutif des malformations artério veineuses superficielles de l'enfant et de l'adulte.
[5] AP-HP, Hôpital Lariboisière, chirurgie ORL et maxillo-faciale ;

Hypothesis:

Evaluation of progression of an AVM is based on the modifications of Blood Flow Volumes (US Imaging) CTscan, MRI, Arteriographies, on successive examinations

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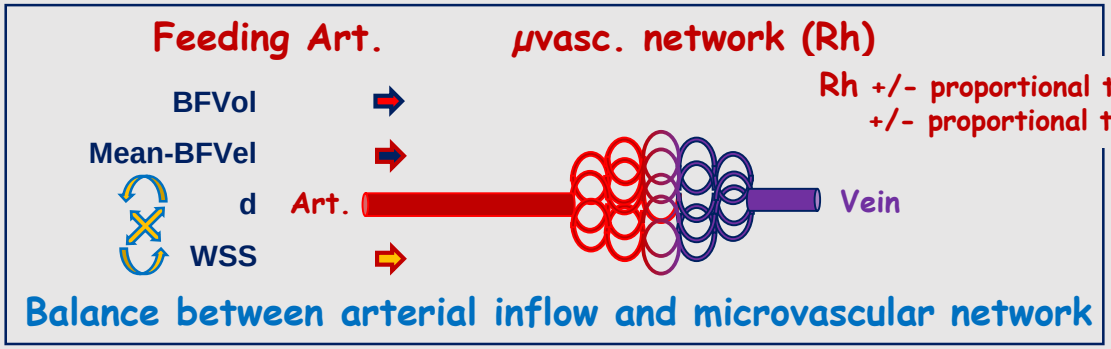
Could Shear Stress measurement in the afferent artery be more efficient ?

… with only one US examination?

Hypothesis:

Normal vascular network



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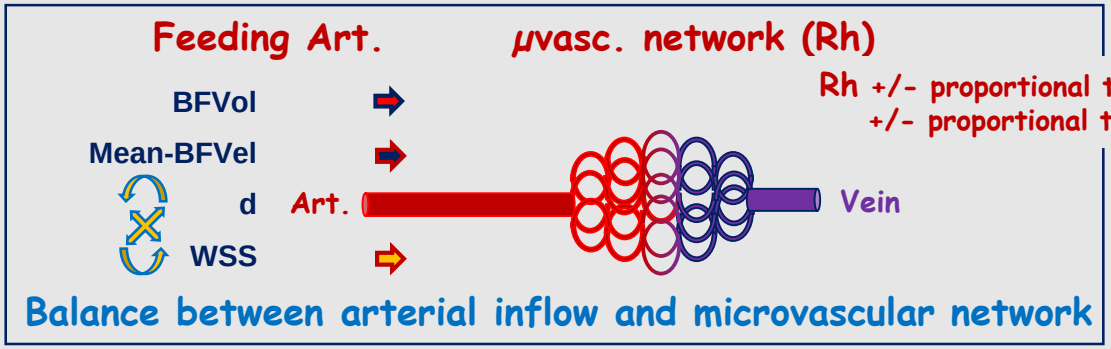
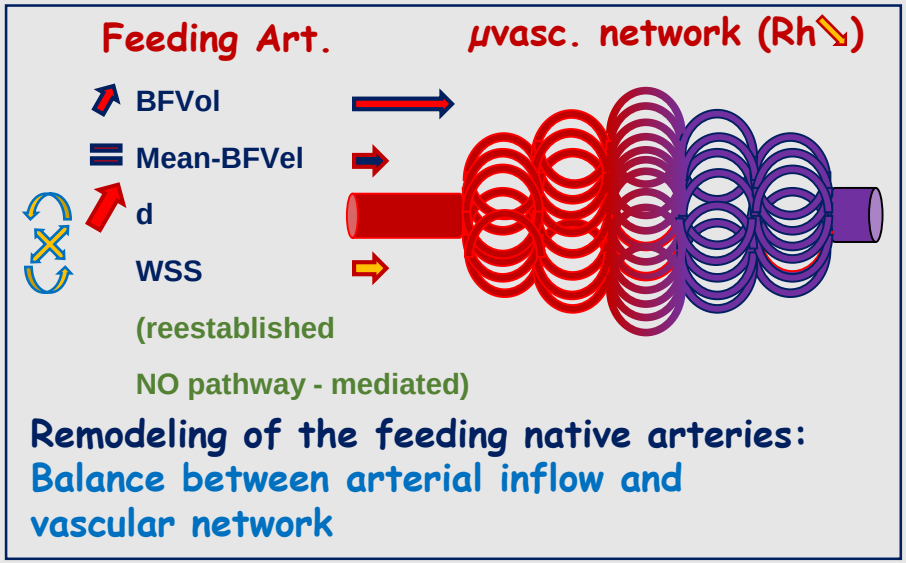


Presence of a sAVM
Stable diseased vascular lesion



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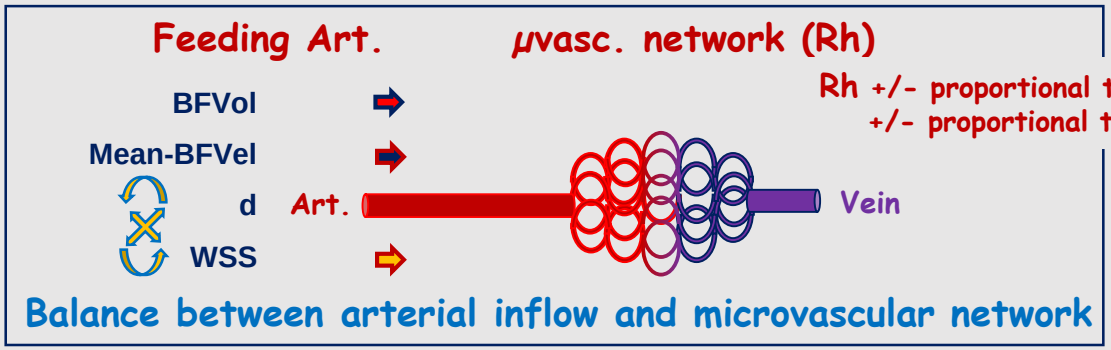

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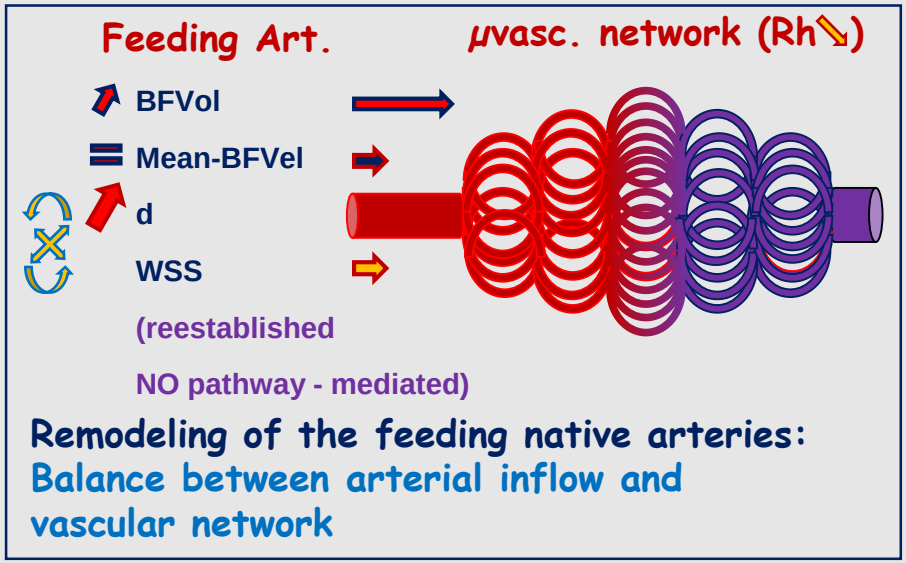
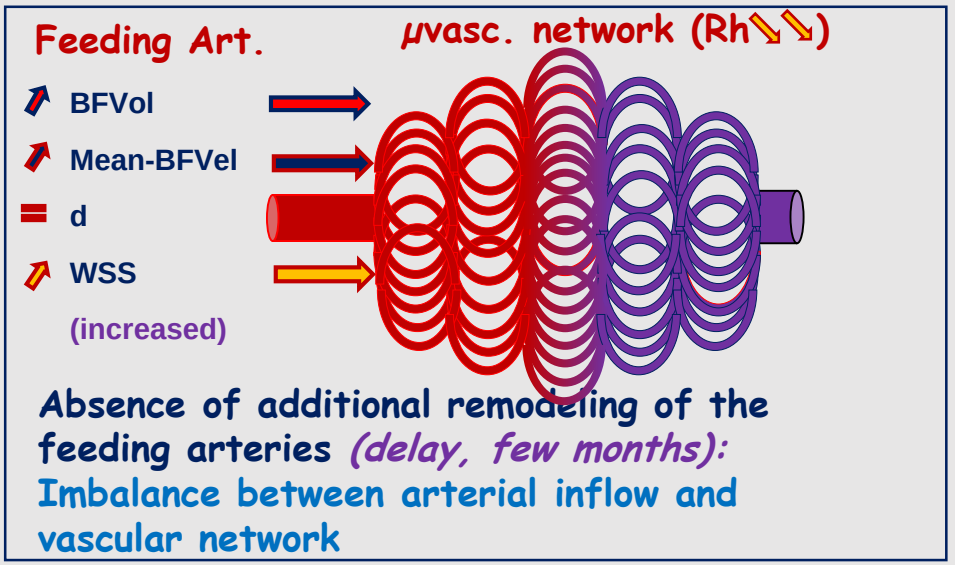


Presence of a sAVM
Progressive diseased vascular lesion



Patients & Methods: prospective blinded study,

25 patients with AVM of the lower part of the face (lips, cheek and mandible)
13 stable AVM, 12 progressive AVM,
judged on absence/presence of a clinical/radiological progression
6 months before and 6 months after the Doppler examination.

compared to
15 previously operated patients for AVM resection (>6 months)
15 healthy controls.

Doppler-ultrasound examination of the ipsilateral and contralateral:
Common carotid arteries, External carotid arteries
Internal carotid arteries Facial arteries (+/- mandibular a.)

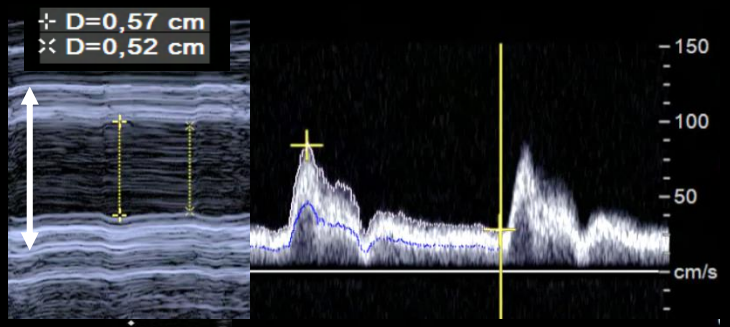
Inner diameters (d, M-mode)
Blood flow velocities (spatial-averaged-time-averaged Mean BFVel, pulsed-Doppler)

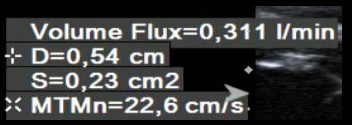
Calculation of Blood flow Volumes: $BFVol = \pi . r^2 . Mean\text{-}BFVel.60$
Calculation of Wall Shear Stress: $WSS = 8.\mu . Mean\text{-}BFVel / d$

Hemodynamic modifications upstream in the native afferent arteries

Right sided AVM of the superior lip

Com.Carot.Art.



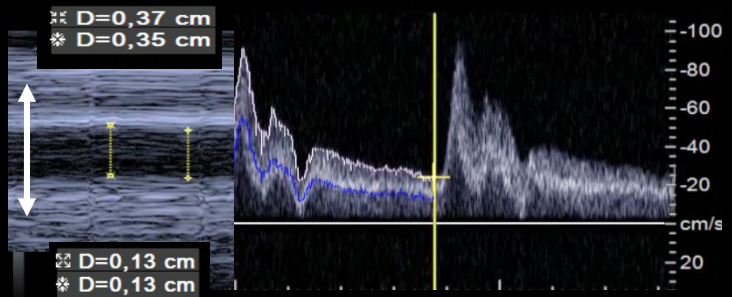


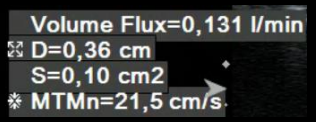
WSS = 11,5 dynes/cm²

Nal:
285+/-68 mL/min
9,5+/-2,0 dynes/cm²

ipsilateral side

Ext.Carot.Art.



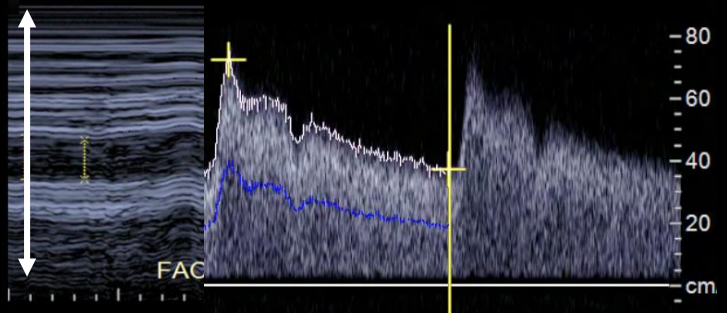


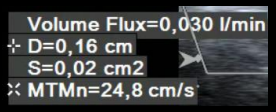
WSS = 16,7 dynes/cm²

Nal:
116+/-34 mL/min
8,8+/-2,9 dynes/cm²

(1cm)

Facial Art.





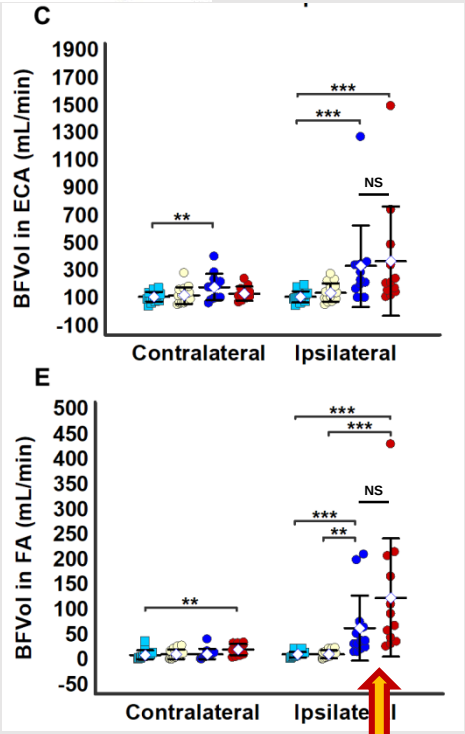
WSS = 53,4 dynes/cm²

Nal:
12+/-9 mL/min
21,6+/-5,8 dynes/cm²

Results:
prediction of progression

- Controls (n=15)
- Operated sAVM (n=15)
- Stable sAVM (n=13)
- Progressive sAVM (n=12)

** p<0,005, *** p<0,001



1. BFVols were +/- identical

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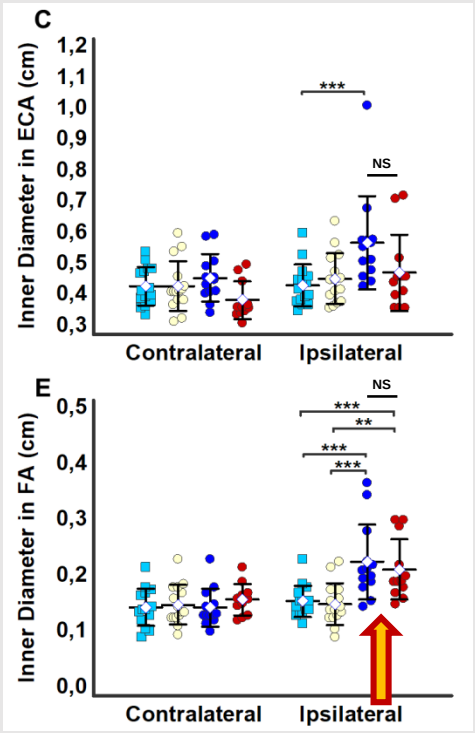

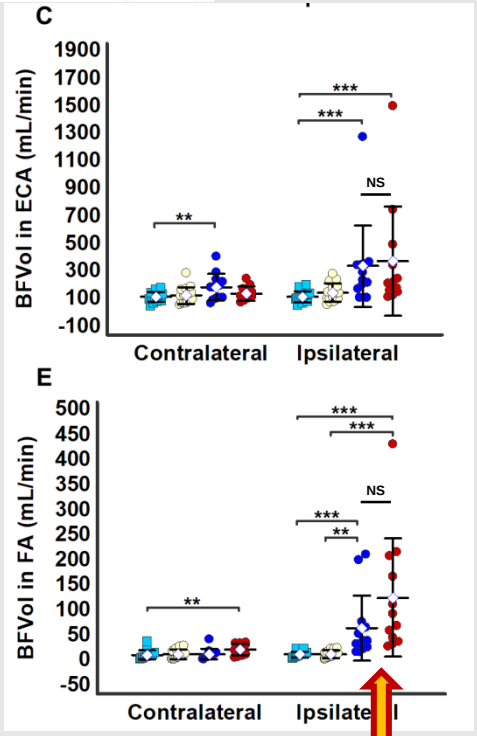

2. arterial remodeling was +/- identical in stable and progressive

1. BFVols were +/- identical

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prediction of progression

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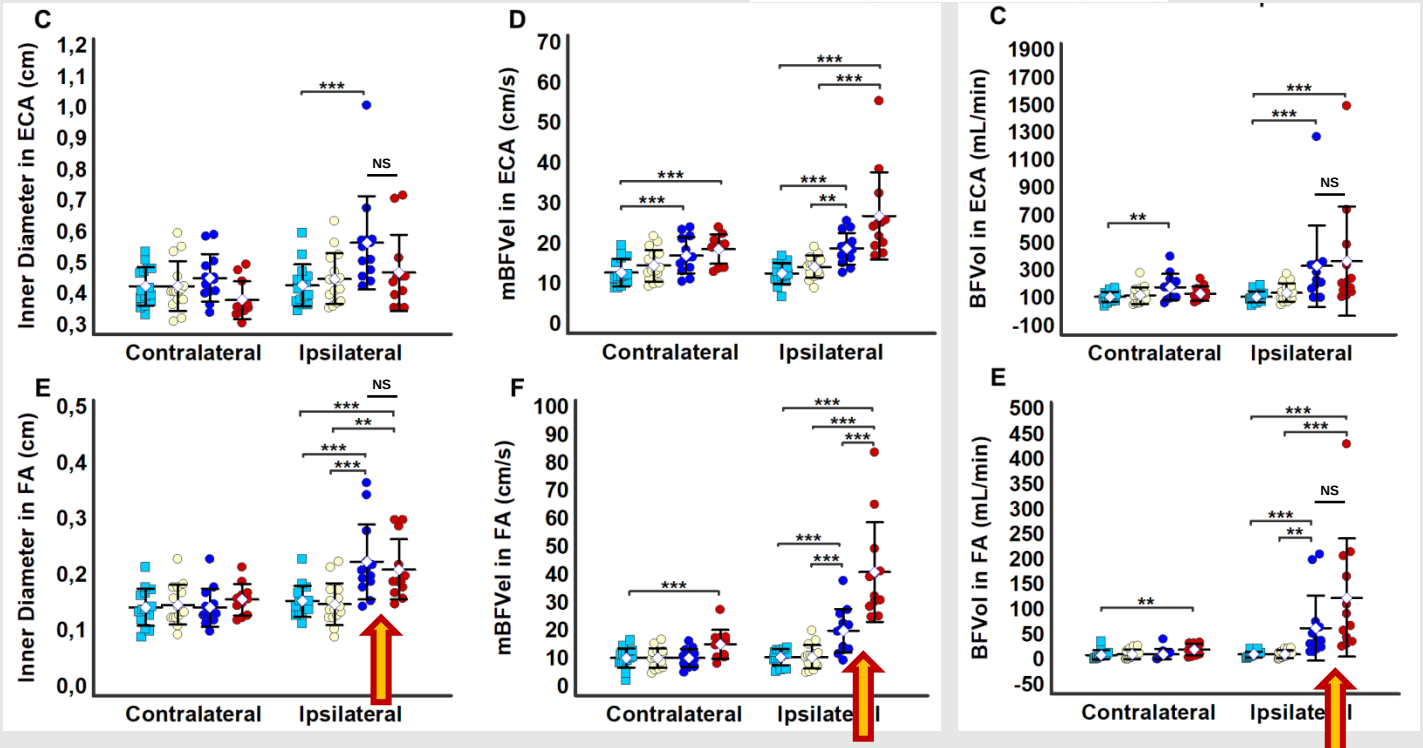
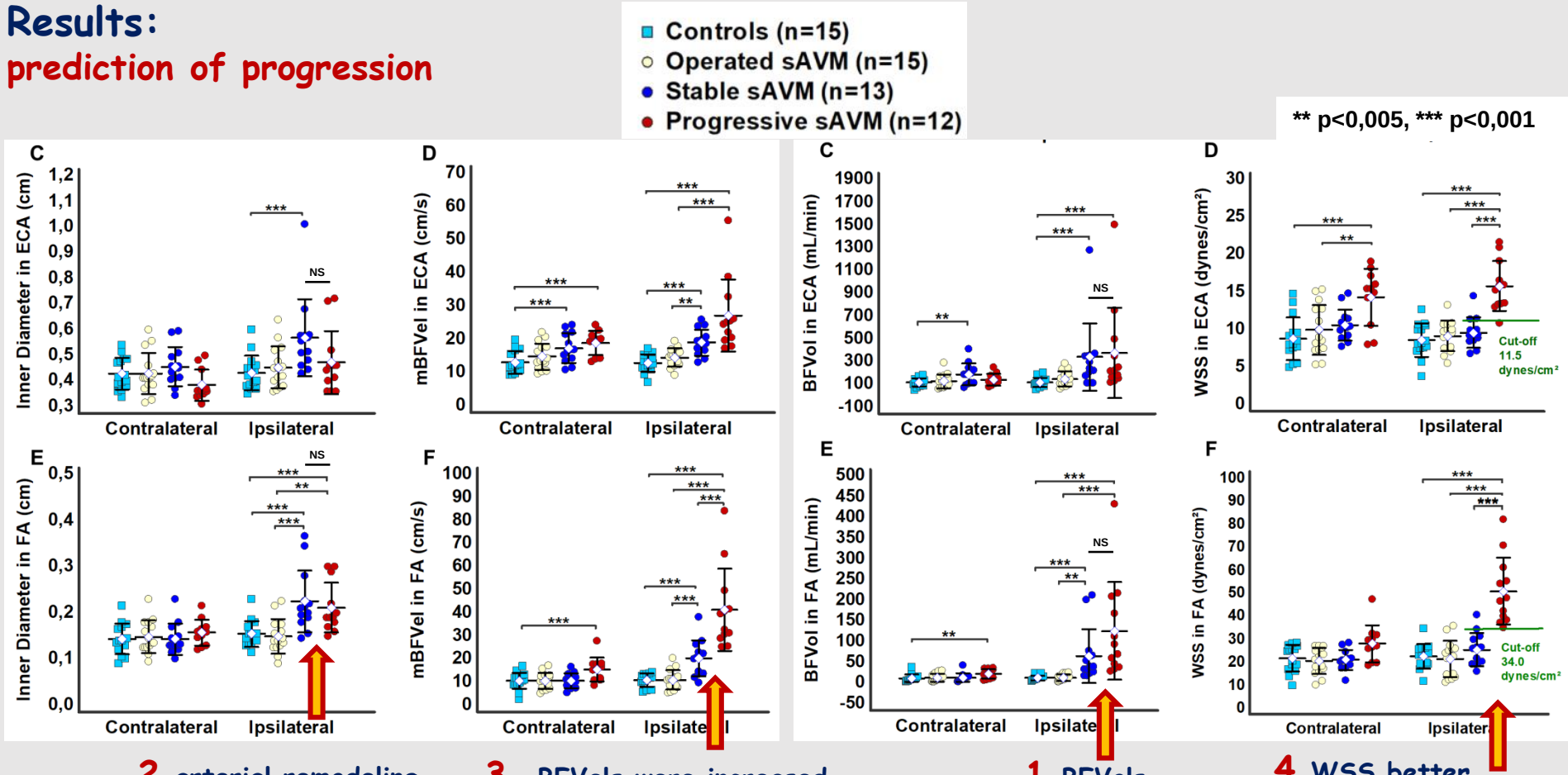


2. arterial remodeling was +/- identical in stable and progressive

3. BFVels were increased in progressive

1. BFVols were +/- identical

Results:
prediction of progression



2. arterial remodeling was +/- identical in stable and progressive

3. BFVels were increased in progressive

1. BFVols were +/- identical

4. WSS better discriminate between stable and progressive

- **WSS in ECA:** cut-off of 11.5 dynes/cm² sensitivity of 92% specificity of 92%
  AUC: 0.955, [95%CI: 0.789–0.998] (p<0.0001).
- **WSS in Facial Artery** cut-off of 34.0 dynes/cm² sensitivity of 100% specificity of 92%
  AUC: 0.974, [95%CI: 0.819–1.000] (p<0.0001).

Conclusions:

- Why arterial Shear Stress is "regulated", "adapted" in the arteries ?
  to decrease the afterload of the left ventricle :

+/- equivalent of a system of economy of energy to perfuse the organs and tissues.

- WSS, determined once in the afferent arteries upstream from an abnormal vascular networks represents a reliable predictive and prognostic biomarker of progression.
- Such measurements can be performed easily using Doppler ultrasound examination of the afferent arteries.
- WSS measurements may assist the clinician in determining when to administrate the appropriate treatments (aggressive ?surgical resection? *vs* conservative).

Thank you for your attention

El Sanharawi I, et al.
Wall shear stress in the feeding native conduit arteries of superficial arteriovenous malformations of the lower face is a reliable marker of disease progression.
Ultraschall in der Medizine 2018 *doi: 10.1055/a-0729-2728.*