

**Volume Analysis Using a Three-
Dimensional Femoral Artery Model
Constructed from Computed Tomography
Angiography Predicts Distal Occlusion**

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Femoral Artery Computational Model

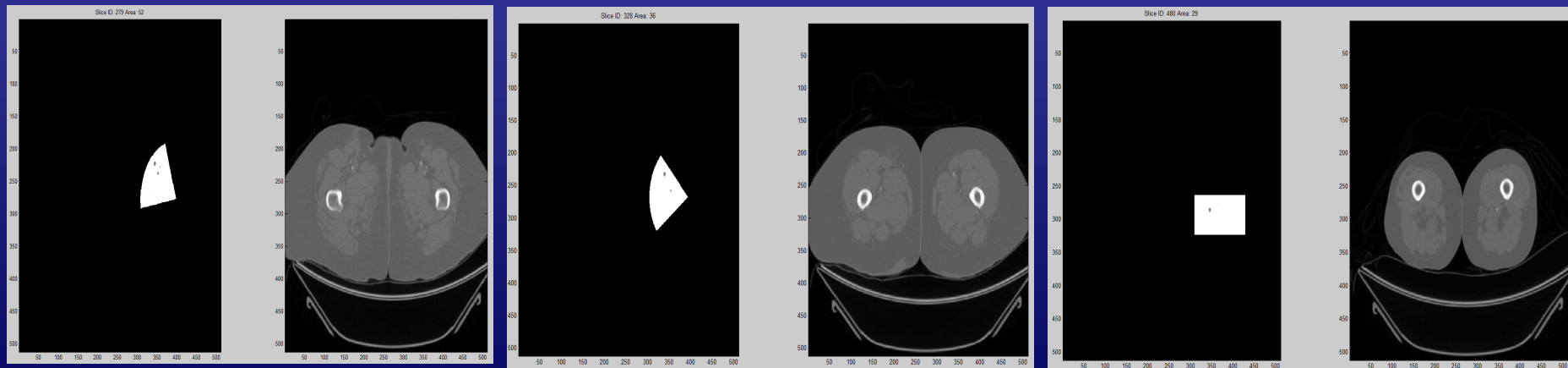
Objective

- To determine whether arterial volumes measured in 3 regions in patients with occluded femoral arteries (OC) differ significantly from those of non-occluded arteries (NOC).
- Proof of concept study to create image metrics for arteriogenesis and angiogenesis to predict clinical events.
- “Teach the computer to read CT angiograms”

Femoral Artery Computational Model

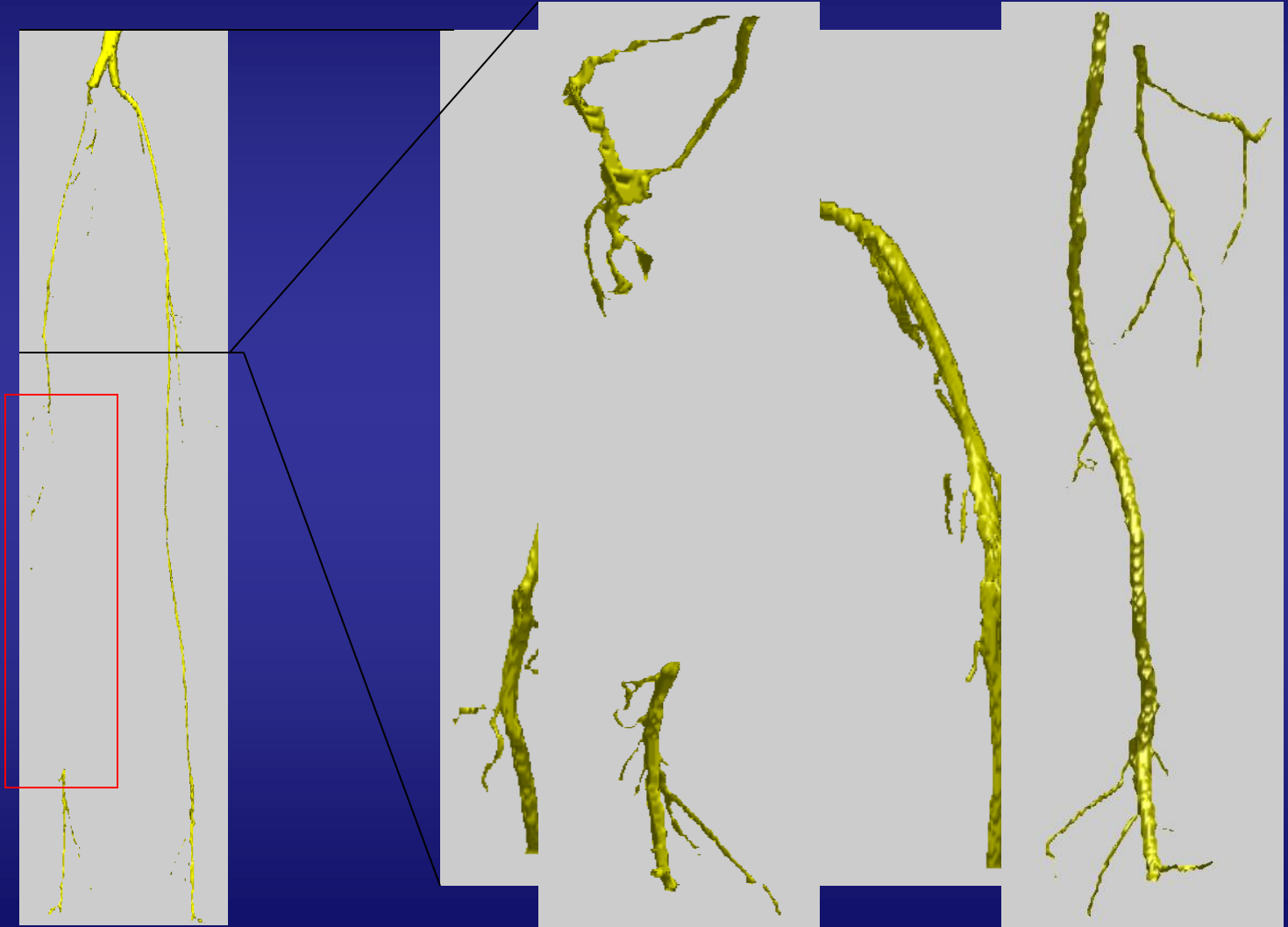
Methods

- 10 patients with computed tomography angiography (CTA) who had a least one occluded femoral artery
- Program created using MatLab
- Developed a semi-automatic model to extract data CTA images in a DICOM format
- 3 dimensional reconstruction of arterial system
- Measured vessel size, the anatomical location of the vessel, and the difference between two adjacent slices.



3D Reconstruction Femoral Artery

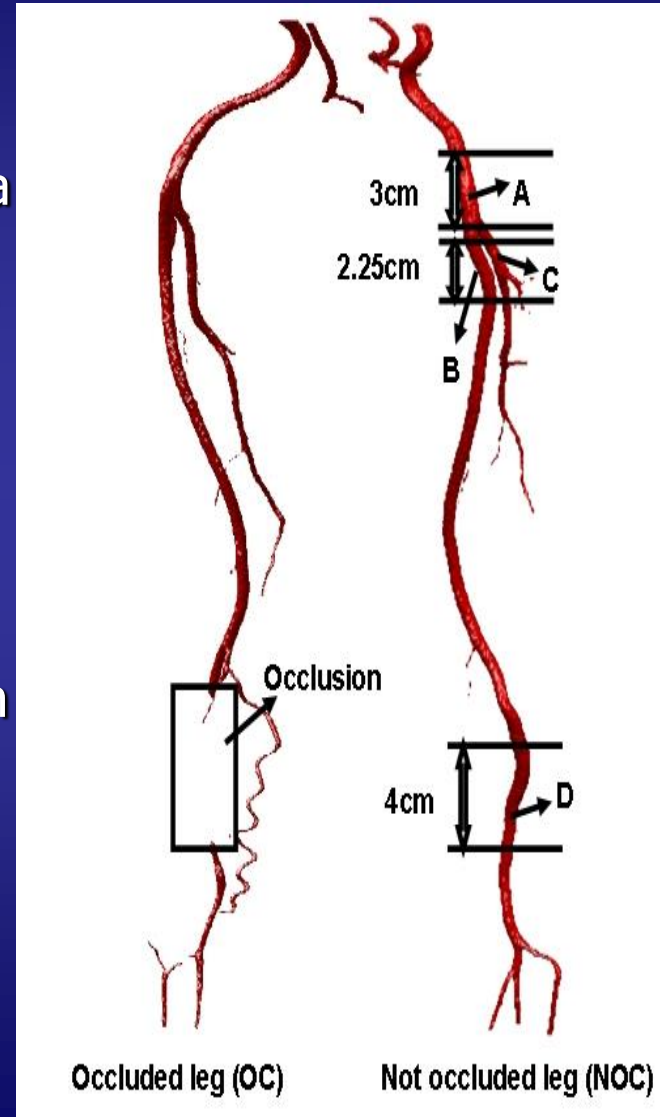
A long
occlusion



Femoral Artery Computational Model

Methods

- Arterial volumes measurements obtained at A, B, C, D, and distal aorta prior to bifurcation
- Common femoral artery (A) = Volume A/ Aorta volume
- Profunda femoral and SFA (B/C) = Volume of C/ Volume of B+C
- Distal SFA (D)= Volume D/ Volume of Aorta
- Computation measurements validated manual counting of selected regions in each patient.
- Logistic regression and the leave-one-patient-out method were used to validate the classification of OC and NOC.

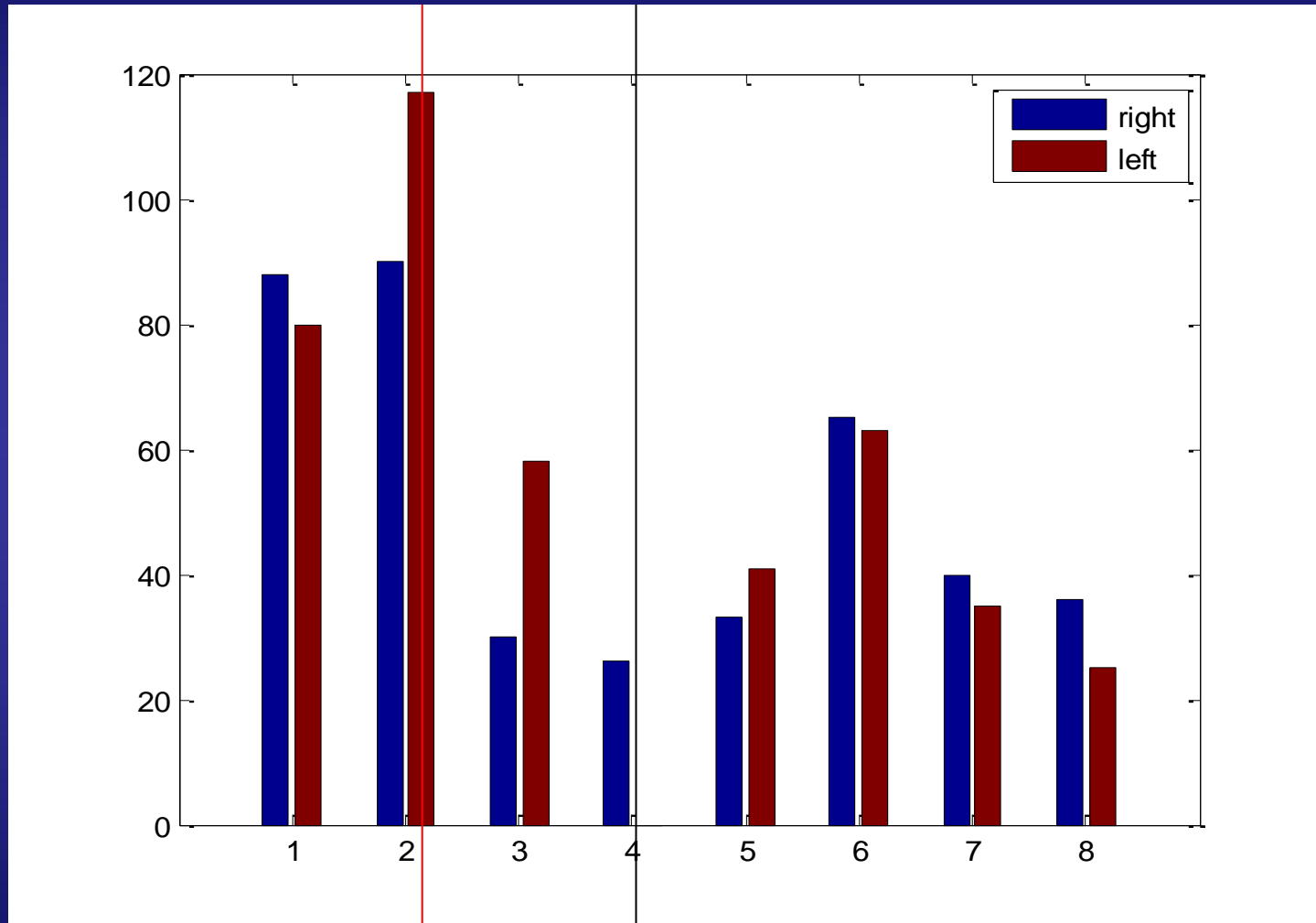


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Results

- 10 patients with 11 OC and 9 NOC femoral arteries
- Volume difference was 10.22 ± 7.05 voxels,
 - Accuracy of 84.06% ($\pm 8.46\%$).
- P1 (common femoral artery) mean values: OC, 5.29 ± 1.90 ; NOC, 5.74 ± 1.66 ; $P=0.58$
- P2 (profunda femoral artery) mean values: OC, 0.78 ± 0.23 ; NOC, 0.57 ± 0.15 $P < 0.03$
- D1 (distal SFA) mean values: OC, 2.47 ± 1.40 ; NOC, 4.19 ± 1.79 $P < 0.03$
- Classification using all three regions achieved 90.91% sensitivity and 77.78% specificity.

Femoral Artery Computational Model



Lumen Volume: Patient 2 (left leg occluded)

Femoral Artery Computational Model

Conclusions

- A semi-automatic model can be used to determine differences in arterial volumes at the PFA and distal SFA to predict occluded femoral arteries.

Drs. Xiaojing Yuan, Ning Situ, and team
at the University of Houston

