ABSTRACT FACE PAGE

1. **Presenting Author's name: Kimberly Stevens Boster**
2. **Presenting Author's affiliation: Purdue University**
3. **Presenting Author's title: Lillian Gilbreth Postdoctoral Fellow**
4. **Presenting Author's email: kastevens@purdue.edu**
5. **Presenting Author's gender (optional): F**
6. **Presenting Author's race (optional): white**
7. **Presenting Author's ethnicity (optional):**
8. **Presenting Author's affiliation sector: (check one or more)**
    - **Academia**
    - Industry
    - Federal Employee/Contractor
    - Private Foundation
    - Other: _____
9. **Presenting Author's Career stage: (check one)**
    - K-12 student
    - Undergraduate student
    - Graduate Student
    - **Post-doctoral Trainee**
    - Young employee (within first 3 year of post-training position)
    - Mid-level employee (3-10 years of post-training position)
    - Senior-level employee (10+ years of post-training position)
    - Other: _____
10. **Website / twitter handle / other public links (optional): _____**
11. **Is this the research presented in this abstract supported by IMAG MSM-related U01 funding? No**
12. **If the Presenting Author is a trainee, who is the trainee's primary research advisor? Vitaliy Rayz_____**

TRAINEE POSTER AND ORAL PRESENTATION COMPETITONS:

New to the meeting this year, we are holding *both* a trainee poster competition and a trainee oral presentation competition! If the presenting author is a trainee (i.e., a student at any level or a post doctoral trainee), he/she may enter his/her abstract in the trainee poster competition, the trainee oral presentation competition, or both competitions. Trainees may also submit more than one abstract to the meeting and enter more than one abstract in these competitions. Prizes will be given to the presenters of the top-ranked trainee oral presentation and the top-ranked trainee poster (judged during the meeting by the Program Committee).

13. **If the Presenting author is a trainee, would the Presenting Author like to enter his/her abstract in the Trainee Poster Competition*? Yes**

*Note: Trainees who enter the poster competition are expected to stand by their poster during the scheduled poster sessions and present them to the judges.

14. **If the Presenting author is a trainee, would the Presenting Author like to enter his/her abstract in the Trainee Oral Presentation Competition**? No**

**Note: The Program Committee will select the top four abstracts from trainees who elect to enter their abstract into the trainee oral presentation competition, these four trainees will be notified by Feb. 17th, and they will deliver their oral presentations (which will be judged) on the second day of the meeting after lunch.

PATIENT-SPECIFIC COMPUTATIONAL MODELING OF CEREBROVASCULAR HEMODYNAMICS

[1]Kimberly A. Stevens Boster,* [1]Ivan C. Christov, [1]Vitaliy L. Rayz
[1]Purdue University, West Lafayette, IN, USA
email: kastevens@purdue.edu

BACKGROUND: Image-based computational modeling of cerebrovascular flows can provide quantitative data to assist clinical decision-making, such as when and how to treat cerebral aneurysms and arteriovenous malformations. We are developing a framework for modeling patient-specific blood flow dynamics in order to provide clinically-relevant hemodynamic descriptors that cannot be obtained from imaging.

METHODS: Vascular geometries for computational models are generated from MR and CT angiography and rotational X-ray angiography data, and the blood flow within the geometry is computed using an open-source software package, SimVascular. Once created, the model is modified to simulate various surgical procedures and predict postoperative flow conditions. Hemodynamic parameters known to influence arterial wall remodeling and intra-luminal thrombus deposition, such as the wall shear stress, oscillatory shear index, and flow residence time, can be quantitatively compared between the pre- and post-operative flow scenarios. The 3D model, which provides detailed information regarding hemodynamics in a specific region of interest, can be coupled with simplified components representing the influence of proximal and distal vasculature. The framework also includes the capability to incorporate fluid-structure interactions between the flow and compliant vessel walls, which may be particularly significant for modeling aneurysms with blebs.

RESULTS: We present two case studies: 1) modeling surgical treatment of a giant basilar artery aneurysm by clipping a supplying vertebral artery; and 2) predicting how the treatment of a downstream arteriovenous malformation (AVM) would affect the flow conditions in two proximal aneurysms of the vertebrobasilar system. Imaging data for the giant basilar artery case was obtained from Barrow Neurological Institute. The left vertebral artery was clipped in an attempt to reduce the flow through the aneurysm, but the compensating flow from the right vertebral artery created a high-speed jet and intra-aneurysmal mixing, as shown in Fig. 1. The simulations indicated that the surgery resulted in increased normalized wall shear stress throughout the cardiac cycle. Imaging data for the second case study, modeling the effect of an AVM on upstream flow, was obtained from IU School of Medicine. Modeling in this case revealed hyperdynamic flow upstream of the AVM leading to elevated wall shear stress. Clinically-relevant, quantitative hemodynamic metrics can be obtained using the described modeling pipeline.

CONCLUSIONS: The results indicate that information delivered by this modeling framework can aid clinicians as they evaluate alternative treatment options on a patient basis.

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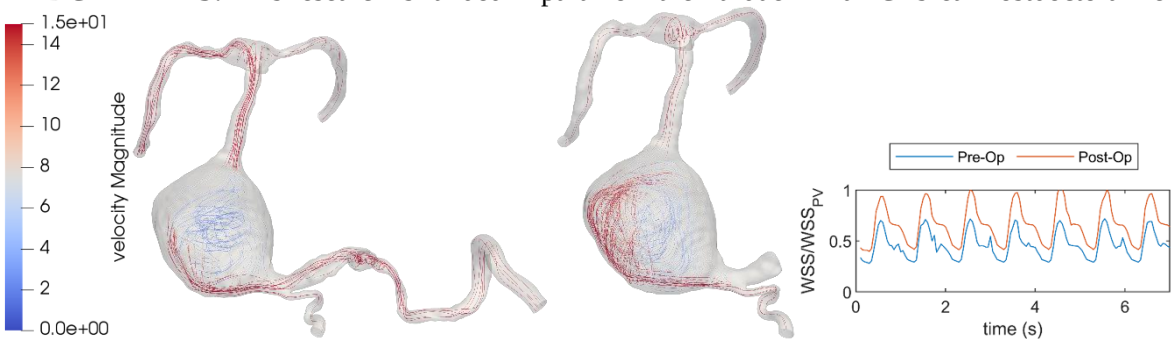

Figure 1. Left panel: Streamlines illustrating flow pre- (left) and post-surgery (center) through a giant basilar aneurysm. The left vertebral artery was clipped in an attempt to reduce flow through the aneurysm, but the compensating flow from the right vertebral artery created a high-speed jet and intra-aneurysmal mixing. Right panel: Average wall shear stress normalized by the averaged parent wall shear stress at systole pre- and post-operation.