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Purpose: AngioLab is a patient-specific software tool developed to assist the clinician in understanding the risk of rupture of intracranial aneurysms and in carrying out advanced interventional planning. Current users of this tool include mainly researchers that are evaluating the potential of its unique features for aneurysm morphological analysis and endovascular treatment planning.

Methods and Materials: Starting from patient-specific standard angiographic images, AngioLab extracts the geometry of the aneurysm and parent vessels in order to fully characterize its morphology. Then, it performs a similarity search in terms of shape and size in a database of aneurysms with known clinical history. By reviewing the clinical history of the resulting treated aneurysms with similar morphology in the database, it facilitates the selection of the treatment strategy.

AngioLab goes one step further allowing aneurysm virtual treatment, to compare and evaluate different therapeutic alternatives, including coil embolization, stenting, or a combination of both. It also provides a way to evaluate the flow alterations induced by the presence of virtual devices (coils, stents or both) and to compare them to the untreated case. The results of different flow simulations representing possible treatment alternatives can be visualized as virtual angiographies that visually look like the standard fluoroscopy procedures. Or they can be visualized as standard computational fluid dynamics visualizations (e.g., wall shear stress or streamlines).

Results: Four of the AngioLab functionalities are illustrated. In Fig. 1, a screenshot shows the list of most similar aneurysms (in terms of shape) after performing the morphological characterization of an aneurysm. In Fig. 2, a combined treatment using Y-stenting and coils is included for a patient-specific geometry. Fig. 3 compares the real angiography for a patient with its simulated counterpart results after the same virtual treatment. Finally, Fig. 4 allows the visual comparison of wall shear stress after simulating the flow, using Computational Fluid Dynamics, in the untreated and treated case.
Conclusion: AngioLab is a software tool that allows patient-specific image-based minimal invasive treatment planning and quantification of cerebral aneurysms. We aim to make it a clinical decision-support tool usable in daily clinical practice.
Fig. 1 Screenshot of AngioLab morphological characterization of the aneurysm and results of the similarity search *(figure1.gif, 64.1 KB)*

![Figure 1: Screenshot of AngioLab morphological characterization of the aneurysm and results of the similarity search](figure1.gif)

Fig. 2 Screenshot of AngioLab virtual treatment using stents and coils *(figure2.gif, 44.9 KB)*

![Figure 2: Screenshot of AngioLab virtual treatment using stents and coils](figure2.gif)
Fig. 3 Screenshot of AngioLab comparing a real angiography with the corresponding virtual angiography obtained from a flow simulation (figure3.gif, 101.7 KB)

Fig. 4 Screenshot of AngioLab showing the wall shear stress for the untreated and treated case (figure4.gif, 28.7 KB)
KEYWORDS

Keyword 1: cerebral aneurysms
Keyword 2: angiography
Keyword 3: computational imaging