AbstractID: 13623 Title: Parameterization of Time-Density Curves (TDC) and Regional-TDC's to quantify flow modification inside aneurysms treated with flow-modifying devices (FMD) following endovascular image-guided interventions

Purpose: Digital Subtraction Angiography (DSA) is used to evaluate endovascular treatments, either visually or using time-density curves (TDC), which present change of contrast as a function of time for either the entire aneurysm or sub-volumes within (R-TDC). Quantitative parameters such as peak-density-value, time-to-peak, input rate, influx, residence time, wash-out-time, and wash-out-rate were used in this study to examine the hemodynamic implications of several treatments using FMDs.

Method and Materials: Flow evaluations for aneurysms (saccular and bifurcation geometries) were done using elastomer-based replicas of clinical human cases. These phantoms were placed in in-vitro pulsatile flow loops containing a blood-simulating solution of glycerin-water. One-cc boluses of iodinated contrast were delivered at the proximal end of parent vessel of each aneurysm via 5-Fr catheters using an automatic injector. DSA sequences were acquired at 30 frames/sec (5-inch II-mode). The necks of the aneurysms were covered using different-porosity FMDs. TDCs were obtained pre-and-post-treatment.

Results: R-TDC metrics indicate important modifications of flow occurred in different areas inside the aneurysm that are not evident from the total-volume TDC. For example, in a sub-region of saccular aneurysm treated with a zero-porosity-patch FMD, occluding the proximal portion of the aneurysmal orifice, peak-density decreased 49% compared to untreated case and the flow behavior is changed from continuous to oscillatory, while the total aneurysm measurement shows a decrease in peak-density of 21% and an increase of wash-out-time of 171% versus untreated case. In a sub-region of the bifurcation aneurysm treated with non-zero-porosity patch FMD placed to occlude the entire neck, time-to-peak increased 67%, and input rate decreased 71% compared to untreated case, while the total aneurysm measurement shows a time-to-peak increase of 20% and an input rate of 50% versus untreated case.

Conclusion: Proposed parameterization of TDC's is rapid and terms have physical meaning.
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