

ON-LINE APPENDIX

HR-VWI Protocol

HR-VWI was performed in a 3T clinical MR imaging scanner (Magnetom Verio; Siemens, Erlangen, Germany) with a 12-channel head coil. The examination protocol included 3D time-of-flight MRA, turbo spin-echo T1WI plain and enhanced scanning, and turbo spin-echo T2WI plain scanning. 3D T1WI plain and enhanced scanning were added in some patients. Gd-DTPA was used as the contrast. The parameters were the following: T1WI scheme—TR = 650 ms, TE = 12 ms, FOV = 130 × 130 mm, acquired matrix = 256 × 256, slice thickness = 1.5 mm, slice gap = 0.15 mm, flip angle = 145°, voxel = 0.5 × 0.5 × 1.5 mm. The scanning scope depended on the size of aneurysm, usually ranging from 9 to 13 layers; mean scanning time was 4 minutes 40 seconds. Axial scanning was performed in all patients. Coronal and sagittal scanning were also performed if necessary. The parameters were the following: 3D T1WI scheme—FOV = 160 × 132 mm, acquired matrix = 256 × 256, slice thickness = 0.7 mm, layer spacing = 0, voxel = 0.6 × 0.6 × 0.7 mm, 56 layers, TR = 600 ms, TE = 20 ms, mean scanning time = 8 minutes by a pulse-gating trigger.

Postprocessing was accomplished with syngo software on the workstation (Siemens). The parameters were the following: T2WI scheme—TR = 3000 ms, TE = 56 ms, FOV = 130 × 130 mm, acquired matrix = 256 × 256, slice thickness = 1.5 mm, slice gap = 0.15 mm, flip angle = 145°, voxel = 0.5 × 0.5 × 1.5 mm. The scanning scope depended on the size of the aneurysm, usually ranging from 9 to 13 layers. The mean scanning time was 4 minutes 40 seconds. Axial scanning was performed in all patients. Coronal and sagittal scanning were also performed if necessary.

3D rotational angiography was performed with the Artis zee biplane angiographic system (VC14; Siemens). During the 5-second digital subtraction angiography acquisition, 20 mL of contrast agent was injected through the internal carotid artery at a

rate of 3 mL/s. With a delay of 1 second, a 180° rotation of the C-arm was performed to obtain 134 frames.

Acquisition of Pulsatile Inflow Velocity

A pulsatile velocity image of the ICA (On-line Fig 1) was obtained from a middle-aged female patient with carotid duplex sonography and then disposed for transparency with Photoshop CS6 (Adobe Systems, Mountain View, California). A screenshot of an Excel table (Microsoft Corporation, Redmond, Washington) was also disposed for transparency (On-line Fig 2). Matlab (MathWorks, Natick, Massachusetts) was used to calculate the functions of the carotid pulsatile velocity waveform (On-line Fig 3). Then the functions were written in C programming language.

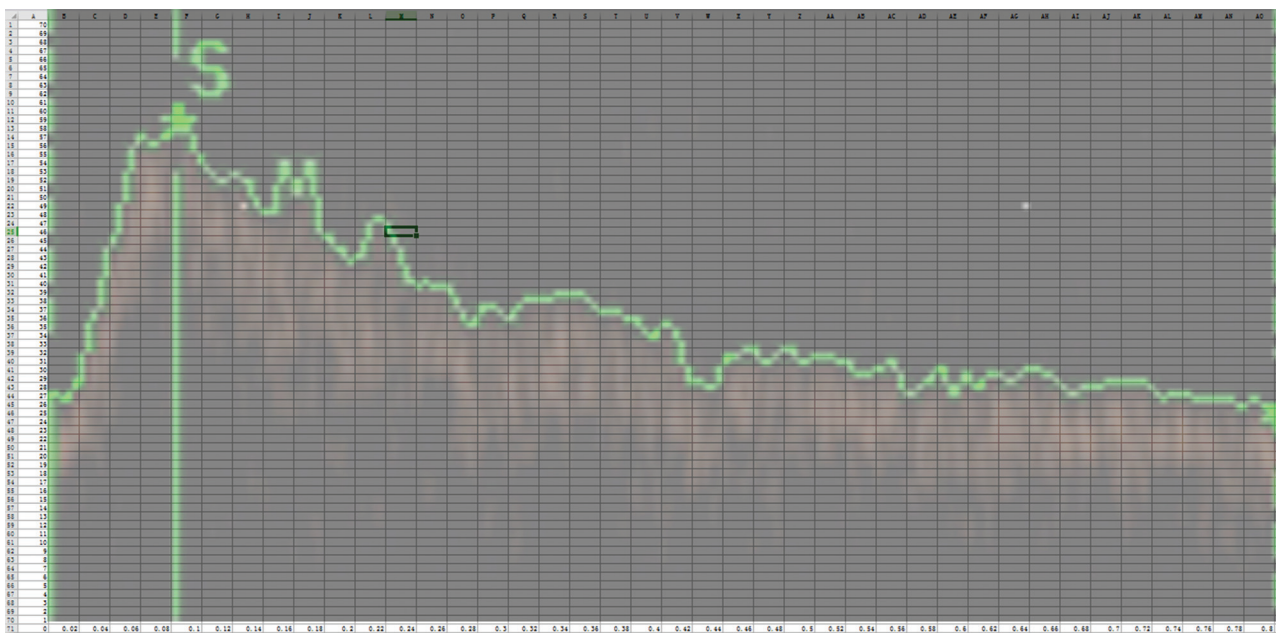
The mean inflow velocity was 36.3 cm/s, the peak systolic velocity was 60.3 cm/s, the end diastolic velocity was 24.6 cm/s, the pulsatility index was 0.984, and the residence index was 0.593. These values were all within normal range.

Pulsatile Inflow Velocity in C Programming Language:

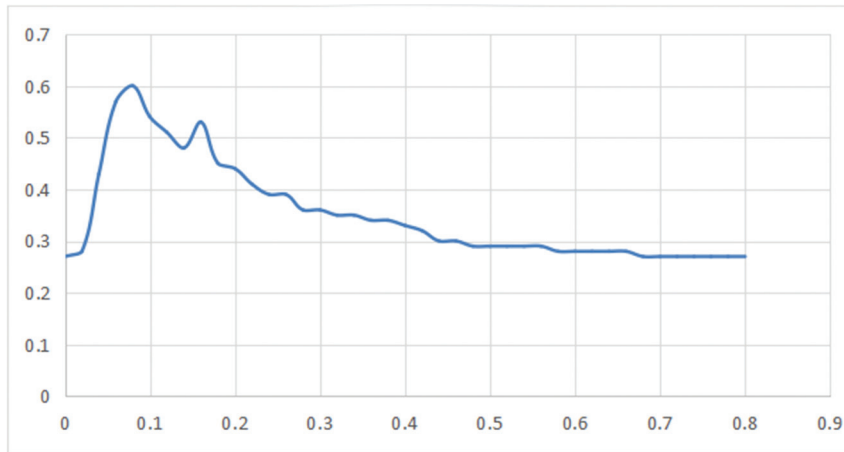
```
#include "UDF.H"
DEFINE_PROFILE(velocity_inlet,thread,i)
{face_t f; begin_f_loop(f,thread)
{ real k = RP_Get_Real("flow-time"); real m = k/0.8; real x =
k-0.8*flhttrhttror(m); real y;
if(x < 0.04) F_PROFILE(f,thread,i) = 0.27;
else if(x <= 0.14) {y = 0*100000*x*x*x*x*x*x-6.51040*
100000*x*x*x*x*x*x+2.86460*100000*x*x*x*x*x-4.7240*10000*
x*x*x*x+3.5479*1000*x*x-1.1575*100*x+1.74; F_PROFILE
(f,thread,i) = y;}
else if(x <= 0.56) {y = -3.4747*1000*x*x*x*x*x*x+
7.6085*1000*x*x*x*x*x*x-6.6915*1000*x*x*x*x+3.008*1000*x*x*x-
7.230168*100*x*x+8.66299*10*x-3.5316; F_PROFILE
(f,thread,i) = y;}
else F_PROFILE(f,thread,i) = 0.27;
end_f_loop(f, thread)}}.
```



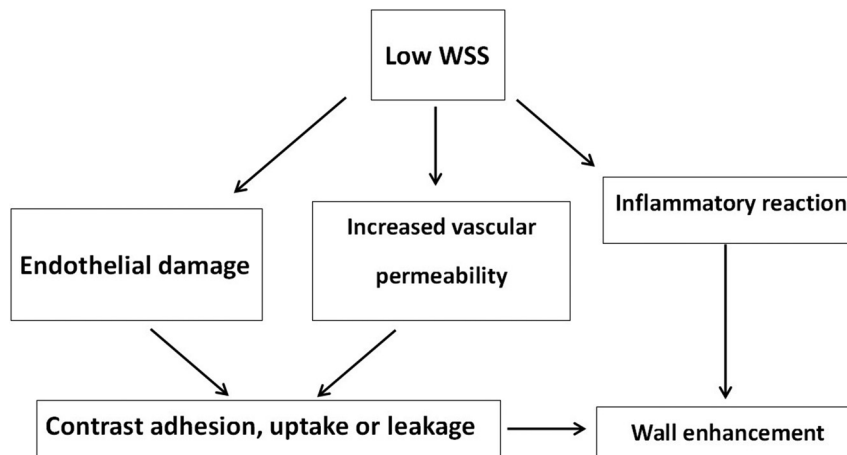
ON-LINE FIG 1. Pulsatile velocity image of the ICA.



ON-LINE FIG 2. Transparent pulsatile velocity image of ICA overlapped with Excel table screenshot.



ON-LINE FIG 3. Coordinates of the pulsatile velocity image.



ON-LINE FIG 4. Mechanism of low WSS contributing to wall enhancement on HR-VWI postgadolinium TIWI.

On-line Table: Hemodynamic comparison between ruptured and unruptured aneurysms^a

Variables	Ruptured (n = 8)	Unruptured (n = 17)	P Value ^b
NP _{en}	0.9175 (0.6122–1.2662)	1.0705 (0.8675–1.3291)	.322
NWSS _{en}	0.5954 ± 0.3094	0.4157 ± 0.2429	.206
OSI _{en}	0.2374 ± 0.0560	0.2248 ± 0.0751	.092
NP _{sac}	0.9146 ± 0.3662	1.0415 ± 0.2808	.621
NWSS _{sac}	0.0364 (0.0220–0.0730)	0.0422 (0.0279–0.0501)	.861
OSI _{sac}	0.3074 ± 0.0809	0.3556 ± 0.0477	.070

Note:—NP_{en} indicates normalized P of enhanced area; NWSS_{en}, normalized WSS of enhanced area; OSI_{en}, OSI of enhanced area; NP_{sac}, normalized P of the whole aneurysm; NWSS_{sac}, normalized WSS of the whole aneurysm; OSI_{sac}, OSI of the whole aneurysm.

^a Data are expressed as means for normally distributed continuous variables, and as the median for non-normally distributed variables. Numbers in parentheses are interquartile range.

^b A P value < .05 was statistically significant.