Response to Letter by van Rooij and Sluzewski

Response:
We read the letter by Drs Willem Jan van Rooij and Menno Sluzewski criticizing our study,1 and herein address their critiques of our methodology and results.

We find the comments of Drs van Rooij and Sluzewski similar in content and tone to their recent letter criticizing another study of packing density which used comparable methods for calculating aneurysm sac volumes.2,3 We invite interested readers to review this letter, from which we conclude that Drs van Rooij and Sluzewski share 4 of our beliefs, which are central to the purpose and design of our study: (1) density of aneurysm packing (volumetric percentage occlusion or VPO) affects durability of occlusion and thus outcome, (2) VPO is generally inversely related to aneurysm volume (higher packing densities are usually achieved in smaller aneurysms), (3) a study measuring packing density must use the most accurate method of calculating VPO available to the investigators, and (4) there is at present no ideal method for measuring aneurysm volume and VPO. Assumptions of spherical or ellipsoid aneurysm shape are commonly used for volume calculations in the aneurysm literature, but will result in reduced accuracy for irregular aneurysm morphologies. Use of commercially available 3-dimensional rotational angiography (3DRA) software requires operator threshold settings, which Drs van Rooij and Sluzewski acknowledge in their previous letter to be problematic. Like others, we have found that interobserver variation in 3DRA threshold selection by experienced neuroradiologists greatly affects calculated volume, and is in our opinion less reproducible than 2-dimensional angiographic analysis, even with its assumption of ellipsoid aneurysm morphology. Drs van Rooij and Sluzewski have proposed in their previous letter that the best analysis is achieved with custom software that they have recently developed and validated. We do not have their product and thus cannot comment on its value, but note that our methods of aneurysm volume calculation are standard in the aneurysm literature. It must be emphasized that the same VPO calculation methodology was applied to both the HydroCoil and platinum coil cohorts in our study. If this method were to systematically overestimate or underestimate aneurysm volume, it would do so for both groups. Similarly, the interesting phenomenon of calculated VPO exceeding 100% occurred only among HydroCoil-treated aneurysms (and generally in smaller aneurysms, which again are those with greater packing density) in our series. The fact that this result was not seen in platinum-treated aneurysms, or in larger aneurysms, makes attribution of this phenomenon to systematic error in aneurysm sac volume calculation unrealistic. Although we have not proven our ascription of this phenomenon to less-than-theoretical expansion of hydrogel in densely packed aneurysms, we believe this explanation is much more plausible. And, for these reasons, we maintain that the 3-fold greater VPO achieved with hydrogel-coated coils relative to platinum coils is real.

We agree with Drs van Rooij and Sluzewski that aneurysm neck width can affect aneurysm recurrence rate after embolization, and the omission of neck width data from our article was an oversight which we would like to correct. The included Table shows that there were no statistically significant differences in neck widths between the HydroCoil and inert platinum cohorts. In our article, we acknowledged the differences in angiographic follow-up interval between the HydroCoil and inert platinum cohorts, and discussed the possible implications of such differences. Drs van Rooij and Sluzewski have not added any information or questions to change our analysis. For reasons previously discussed, we do not believe the difference in retreatment rates is likely explained by a difference in angiographic follow-up.

In summary, we reported our single-center experience with a new coil technology, HydroCoils, and examined how this technology might affect multiple outcomes, including cost, safety, efficacy, and early durability. In this series, we found that use of HydroCoils increased aneurysm packing density 3-fold, and follow-up angiography at mean 12.3 months suggested a one-third reduction in need for retreatment when compared with a historical cohort of size- and shape-matched aneurysms treated with inert platinum coils. We emphasize that this is a single-center series, and that we do not have long-term angiographic follow-up. We look forward to the publication of multicenter trials with long-term angiographic follow-up to corroborate our findings.

Disclosures
T.W.M. is a stockholder of MicroVention Inc, Aliso Viejo, Calif.

Tim W. Malisch, MD*
Franklin A. Marden, MD**
Ron C. Gaba, MD

Department of Radiology
University of Illinois Medical Center
Chicago, Ill


*Current affiliation: Alexian Brothers Medical Center, Elk Grove Village, Ill.
**Current affiliation: Fairfax Radiology, Fairfax, Va.

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Neck Widths in HydroCoil and Inert Platinum Cohorts

<table>
<thead>
<tr>
<th></th>
<th>HydroCoil</th>
<th>Platinum</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>2.5 (n=17)</td>
<td>3.0 (n=29)</td>
<td>0.260</td>
</tr>
<tr>
<td>Medium</td>
<td>3.3 (n=26)</td>
<td>3.0 (n=24)</td>
<td>0.159</td>
</tr>
<tr>
<td>Large</td>
<td>3.7 (n=5 )</td>
<td>4.0 (n=3 )</td>
<td>0.482</td>
</tr>
<tr>
<td>Recurrent</td>
<td>4.0 (n=7 )</td>
<td>3.0 (n=10)</td>
<td>0.222</td>
</tr>
</tbody>
</table>
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