

# Management of wide-neck aneurysms in 2024: how does one make the best treatment decision when there are so many good options?

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A middle-aged patient walks into the office for the first time with an unruptured, medium sized, wide-neck middle cerebral artery (MCA) aneurysm incorporating both M2 origins into the aneurysm neck. What is the best management for this patient? What is the safest and most effective treatment option? How does one make the decision when there are so many good options currently available?

Wide-neck aneurysms (WNAs) are defined as those with a neck width  $>4$  mm, a dome to neck ratio  $<2$ , or both features.<sup>1</sup> They may be ruptured or unruptured. These aneurysms are more challenging to treat and require more advanced techniques<sup>2</sup> in comparison to narrow-neck aneurysms for which stand-alone coiling is often very straightforward, low risk, and effective. The treatment options in 2024 for WNAs are seemingly endless and include (but are not limited to) microsurgical (MS) clipping, balloon assisted coiling (BAC), stent assisted coiling (SAC; e.g., Atlas (Stryker, Fremont, CA), Low-Profile Visualized Intraluminal Support (LVIS, MicroVention, Aliso Viejo, CA)), temporary SAC (e.g., Comaneci Device (Rapid Medical, Yokneam, Israel)), complex SAC (eg, Y stent, X stent, transcirculation approaches<sup>3</sup>), flow diversion (FD; e.g., Pipeline (Medtronic, Irvine, CA), FRED (MicroVention, Aliso Viejo, CA), Surpass (Stryker, Fremont, CA)), FD assisted coiling, other types of assisted coiling (e.g., Pulserider Device (Cerenovus, Fremont, CA)), and, most recently, intra-saccular devices (e.g., Woven EndoBridge (WEB) device (MicroVention, Aliso Viejo, CA), Contour Device (Stryker, Fremont, CA), Nautilus Device (EndoStream, Tel Aviv, Israel)).

The first consideration might revolve around the age-old question of MS versus endovascular therapy (EVT). Unfortunately, some of the highest level data on the topic is either outdated and/or not specific

to WNAs. Both ISAT<sup>4</sup> and BRAT<sup>5</sup> 1-year outcomes demonstrated improved clinical outcomes for patients who underwent ruptured aneurysm coiling compared with clipping, but these randomized controlled trials (RCTs) are becoming outdated (especially with regards to EVT) and also included all aneurysms, so that the results are not directly applicable to WNAs. More recently, the CURES trial<sup>6</sup> compared EVT and clipping for unruptured aneurysms and found better angiographic outcomes (primary outcome) with clipping with similar final clinical outcomes (secondary outcomes). There were, however, more new neurological deficits and longer hospitalizations with clipping. Again, this trial did not specifically include WNAs but instead any patient 'eligible for both surgical or endovascular options'. So the results may also not be directly applicable to WNAs.

While these RCTs may not have focused on WNAs, there are some data that have (although lower quality compared with RCTs). Two studies (a post hoc analysis of BRAT<sup>7</sup> as well as the prospective EVERRUN Registry<sup>8</sup>) specifically evaluated ruptured WNAs and had different results than ISAT and BRAT 1 year, this time with similar clinical outcomes in both the EVT and MS cohorts, and superior angiographic outcomes in the MS cohort. On the other hand, an analysis from the unruptured arm of the same registry<sup>9</sup> demonstrated superior clinical outcomes with EVT and superior angiographic outcomes with MS. A recent retrospective analysis of MS versus WEB for wide-neck bifurcation aneurysms (WNBAs) demonstrated similar clinical outcomes and superior angiographic outcomes with MS.<sup>10</sup> Beyond WNAs in general, the MCA location has drawn significant interest in this debate, and the literature has been fairly consistent with better angiographic outcomes / similar or slightly worse clinic outcomes with MS.<sup>11 12</sup> These additional studies suggest that MS should remain in the treatment decision conversation, especially for ruptured WNAs.

Beyond the 'clip vs. coil' debate in the literature, there are numerous studies comparing the various EVT options. With so many treatment options and different clinical scenarios (e.g., rupture status), the number of comparisons to make can become cumbersome. Some examples include: a recent meta-analysis found that SAC was superior to non-SAC but with higher risk of complications.<sup>13</sup> A multicenter analysis comparing SAC and WEB for only ruptured WNAs found similar complete occlusion rates, but SAC had significantly higher risk of complications, ischemic events, and external ventricular drain hemorrhage.<sup>14</sup> There are also comparative data within a certain treatment method (e.g., FD), such as this recent study comparing Pipeline (Medtronic, Irvine, CA) versus FRED (MicroVention, Aliso Viejo, CA), demonstrating improved occlusion rates and less in-stent-stenosis with Pipeline (Medtronic, Irvine, CA), but more periprocedural complications.<sup>15</sup> These are just a few examples and there are many more studies that could be discussed,<sup>16 17</sup> but is well beyond the scope of this editorial.

So how does one make the decision for any individual patient or aneurysm? I would advocate that the process begins with high quality training.<sup>18</sup> Residents, fellows, and young attendings must have the proper experience with all techniques so that no single technique becomes diluted to the point of unsafe inexperience. Similarly, we must maintain high standards for hospitals that perform aneurysm treatment.<sup>19 20</sup> The explosion of thrombectomy for acute ischemic stroke as well as the demand to offer this procedure as far and wide as possible has the potential unintended consequence of also diluting aneurysm care also to the point of unsafe inexperience. Multidisciplinary teams<sup>21</sup> and conferences are essential to improve patient outcomes. Bringing team members from all three disciplines (neurosurgery, neurology, and neuroradiology) to the table and discussing treatment plans is invaluable and will bring different perspectives and experiences.

We must continue to perform high quality, prospective, unbiased comparative studies to better understand how all these treatment options perform against each other. Large, multicenter registries such as STAR and NVQI-QOD<sup>12</sup> can be utilized to increase the patient number in each cohort and improve the power of the study. It is imperative, however, to assure high quality data collection, otherwise there is a risk of inaccurate results. Finally, it is critical to have an honest assessment of one's own

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outcomes, successes and failures alike. We must keep track of cases, write down complications, discuss the complications in a morbidity and mortality conference, and learn from mistakes so that the next patient benefits.

Ultimately the treatment choice is an art. It is important to understand both the patient and the aneurysm. Is the patient old or young? Healthy or sick? Is the aneurysm ruptured or unruptured? What is the angiographic anatomy? Are there additional aneurysms? Are blood thinners an option? It is critical to gather as much information as possible and then choose the treatment that is the safest and most effective for any individual patient/aneurysm.

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**Contributors** I am the sole author.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** JM is a consultant to Stryker Neurovascular.

**Patient consent for publication** Not applicable.

**Ethics approval** Not applicable.

**Provenance and peer review** Commissioned; internally peer reviewed.

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**To cite** Mascitelli JR. *J NeuroIntervent Surg* 2024;**16**:433–434.

Accepted 14 March 2024

*J NeuroIntervent Surg* 2024;**16**:433–434.  
doi:10.1136/jnis-2024-021732

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