# Decoding the data: a comment on the American Heart Association/American Stroke Association (AHA/ASA) 2023 Guideline for the Management of patients with Aneurysmal Subarachnoid Hemorrhage

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## SUMMARY

### GUIDELINE SUMMARY

The *2023 Guideline for the Management of Patients With Aneurysmal Subarachnoid Hemorrhage* was recently released with endorsements from multiple societies, including the Society of NeuroInterventional Surgery.[1] All who worked on this document should be congratulated for their work, as it provides many updates, and addresses new components of aneurysmal subarachnoid hemorrhage (aSAH) care. We encourage providers to thoroughly read the statement. While this Guideline statement is thorough, it is important to highlight opportunities for future research, and gaps in the literature, where rigorous adherence to evidentiary levels leaves providers without clear guidance.

There are several new topics and recommendations included in the Guideline. These include new updates supporting the treatment of aSAH patients with advanced age, while recommending against treatment of those with irreversible neurological injury. The Guideline clarifies the use of lumbar puncture in assisting in diagnosis, while supporting the use of diagnostic angiography to guide treatment strategy. The Guideline supports treatment of aSAH patients in dedicated neurocritical care units and clarifies perihemorrhage blood pressure management. While reversal of anticoagulation is supported, the routine use of antifibrinolytics is not. It supports the optimal time window for definitive aneurysm treatment as within 24 hours of symptom onset, and supports partial treatment to secure the ruptured aneurysm (followed by definitive retreatment later). The Guideline indicates a preference for endovascular treatment in posterior circulation aneurysms, while supporting both endovascular and surgical treatments for the anterior circulation. It supports surgical intervention for intraparenchymal hematoma evacuation, and notes the roles for stent-assisted coil embolization and flow diversion for complicated aneurysms (wide-necked or blister aneurysms not amenable to primary coiling or clipping). The Guideline now also directly addresses the roles of mannitol/hypertonic saline in controlling cerebral edema and intracranial pressure, and supports medical optimization of glycemia, pain, and nausea. The new Guideline recommends euvolemia, dispelling the role of hypervolemia (a traditional aspect of 'Triple-H' therapy). It codifies important nursing protocols for monitoring and care, including encouraging protocols for ventriculostomy management. It recommends against prophylactic statins and magnesium and dispels the routine use of prophylactic blood pressure augmentation. It clarifies management of seizures and seizure prophylaxis, distinguishing management in those who present with versus without clinical seizures. It supports multidisciplinary assessment and discharge planning for rehabilitation and recognizes the need to address psychiatric and cognitive outcome recovery. Finally, it supports protocols for short- and long-term surveillance of aneurysms for recurrence. As such, this Guideline represents a rigorous and thorough approach to aSAH care in the modern era.


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The rigor applied to the Guideline is well-described; Table 2 of the Guideline reprints the American Heart Association standardized approach to evidence assessment and incorporation. It is crucial to understand these designations, and to highlight, through their incorporation into the specified recommendations, current gaps and opportunities requiring future clarification. The Guideline is a reflection of the current strengths and weaknesses of the published literature and aids understanding of the important areas for further study.

### Hospital designation versus volume

The Guideline recommends patient transfer to centers with larger volumes of aSAHs, but includes mentioning of 'comprehensive stroke center' capabilities. Despite discussion of the supportive evidence focused on improved clinical outcomes associated with high-volume centers, specific note is made that stroke center designation have lower mortality rates. We call attention to this point to note that case volume should be emphasized more than a specific 'stroke center' designation. The evidence originates from a single retrospective study that associated in-hospital survival with admission to designated stroke centers per the New York State Department of Health, based largely on administrative billing data.[2] Indeed, the lack of quality-of-care metrics that define stroke center designation/certification in this study was identified as a limitation by its authors, as well as other confounding factors such as self-selection bias and disease severity. Therefore, with current evidence, we believe case volume remains a more robust indicator of a hospital with better outcomes than one with a specific type of 'stroke center'.

### Durability of endovascular treatments

The Guideline recommends that "for patients <40 years with aSAH, clipping of the ruptured aneurysm might be considered as the preferred mode of treatment to improve durability of the treatment and outcome". Certainly, coiling is known to have higher rates of incomplete occlusion, recurrence, and retreatment in comparison to clipping both in randomized controlled trials (RCTs) and other studies.[3–5] Based on these studies, clipping would seem a more "durable" treatment. However, by suggesting that younger patients should be clipped, this recommendation calls into question the long-term durability of aneurysm coiling. Early (within 6 months) recanalization is known to be more common

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than late recanalization: 15% versus 6% in one study evaluating 870 coiled aneurysms.[6] The same authors also evaluated only the aneurysms that were completely occluded at the 6-month time point and found that the risk of a delayed recurrence beyond 6 months to be 6.2%, with the risk decreasing over time.[7] In another study evaluating the risk of a very delayed recurrence, 339 coiled aneurysms that were completely occluded at the 36-month time point only had a 1.5% chance of a very delayed recurrence beyond that time.[8] Thus, although younger patients may have more potential years to live compared with older patients, both age groups are subjected to the more common early (<6 months) recurrence risk. Further, although clipping is classically thought to have a very low recurrence rate, not all studies support that notion, such as the Han *et al* long-term follow-up study on 1601 patients who underwent clipping of a ruptured aneurysm with an overall recurrence rate of 10.1% over 5681 patient-years.[9] Even if we accept that clipping is "more durable" than coiling, the decision to clip or to coil is far more nuanced than simply using an arbitrary age cut-off to favor clipping. Treatment decisions should always be based on a combination of many factors including: patient age, medical comorbidities, Hunt–Hess grade, aneurysm location, size and local anatomy, operator experience and comfort, and treatment factors including "durability". The goal is to secure the aneurysm with the lowest possible risk. For example, should a 35-year-old with a ruptured, narrow-neck, small-sized, posteriorly projecting, basilar apex aneurysm be offered clipping simply because the patient's age is less than 40? Similarly, should a 45-year-old with a ruptured, wide-neck, medium-sized, inferiorly projecting, middle cerebral artery bifurcation aneurysm incorporating both M2 branches into the neck be offered endovascular management because they are aged greater than 40? Age alone is not sufficient to differentiate between an aneurysm highly suitable for endovascular treatment versus one highly suitable for microsurgical treatment.

## Incorporating new devices such as endosaccular flow diverters

Technical innovation has been and continues to be a hallmark element of the neurointerventional space. Incorporation of new devices requires accumulation of rigorous data. While the reliance of such data are a strength of the Guideline, they cannot make conclusions about emerging technology. The current use of endosaccular flow diverters is one such example. The WEB device (MicroVention, Aliso Viejo, CA, USA) is the most well-known intrasaccular device (ISD), but there are additional ISDs such as the Contour device (Cerus Endovascular, Freemont, CA, USA) and the ARTISSE intrasaccular device (Medtronic, Minneapolis, MN, USA), formerly the LUNA aneurysm embolization system (AES) (NFocus Neuromedical, Palo Alto, CA, USA). ISDs have gained popularity over the last 5 years for the treatment of both unruptured and ruptured wide-neck bifurcation (WNBA) aneurysms. They are of particular interest in the setting of aSAH given the potential to treat a WNBA that otherwise would require either surgical clipping or stent-assisted coiling, the latter requiring the use of dual antiplatelet therapy.

The best available evidence evaluating ISDs for ruptured aneurysms is limited to the evaluation of the WEB device in observational studies focused on safety and efficacy without a comparison cohort. The CLinical Assessment of WEB device in Ruptured aneurYSms (CLARYS) study is a prospective, multicenter study conducted in 13 European centers, including patients with ruptured WNBAs consecutively treated between February 2016 and September 2017.[10] Technical success was 93.3%, while complication rates were low: rebleeding 0.0%, procedure- or device-related complications 3.3%, mortality 3.8% at 1 year, overall morbidity at 1 year 9.6%, and WEB-related morbidity 0.0%. At 1 year, 41.3% of aneurysms were completely occluded (Raymond-Roy Class I; RR I), 45.7% residual neck (RR II), and 13.0% residual aneurysm (RR III) with 13% retreatment rate.[11] While this study did have independent radiographic adjudication, it lacked a randomized comparison treatment group. The WorldWideWEB Consortium is an international multicenter cohort including patients with both unruptured and ruptured aneurysms treated with the WEB device. A recent analysis[12] comparing unruptured to ruptured aneurysms (of which the former has been more extensively studied) using propensity score analysis demonstrated no significant difference in rates of adequate occlusion or complications. There were no episodes of rebleeding in the ruptured cohort, providing further evidence in support of treating ruptured aneurysms with WEB. While encouraging, it should be noted that these were data collected institutionally without specific procedural or follow-up protocols used in RCTs, and without a comparative control group. Most recently, Adeeb *et al* evaluated WEB efficacy based on aneurysm location.[13] Although a retrospective cohort analysis without a non-WEB control group, this multicenter study of 572 aneurysms found that WEB had a higher rate of "adequate aneurysm occlusion" at the basilar artery tip and internal carotid bifurcation in comparison to the middle cerebral and anterior communicating artery locations. Clearly, more rigorous and granular data are needed here.

We evaluate all proposed treatments for aneurysms based on safety (complications, clinical outcome) and efficacy (angiographic occlusion). Based on the available data, ISDs appear to be safe with low risks of complications, but there are certainly questions of efficacy. It should be noted that the data do report some significant rates of non-occlusion, and it remains to be seen if the large cohort of aneurysms with neck remnant remain stable or recanalize with longer follow-up. Further, more rigorous and long-term data are needed to make more definitive statements regarding ISDs. Based on the available data, the use of ISDs represents a reasonable additional tool for ruptured WNBAs, and could be considered a first-order treatment. Close angiographic follow-up is warranted, and more adjudicated studies are needed to provide a true level-of-evidence assessment.

## Dissecting aneurysms

The 2023 Guideline does not directly address treatment of aSAH due to dissecting aneurysms or cerebral artery dissections. Arterial dissections that extend through the entirety of the arterial wall may result in aSAH, and open neurosurgical repair of these pathologies remains challenging due to the underlying fragility of the affected artery. Emerging literature suggests that dissecting aneurysms may be successfully treated with endovascular flow diversion with reasonable safety, although robust prospective studies that validate this treatment approach are currently lacking. The development of antithrombotic coating on next-generation flow-diverting stents may provide additional protection against thromboembolic complications and perhaps lead to a reduced need for dual antiplatelet therapy in these aSAH patients in the future. Ongoing prospective studies will validate this treatment approach.

In conclusion, the *2023 Guideline for the Management of Patients With Aneurysmal Subarachnoid Hemorrhage* adds vital new guidance to the management of aSAH. It provides key new findings for providers using the currently available



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evidence. While the aforementioned topics are controversial and/or omitted, they mostly reflect the need for more rigorous studies, and highlight current hot topics in our field.

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