PANEL DISCUSSION

MMA Embolization for Subdural Hematoma: Practice Considerations and Future Applications

The impact of new middle meningeal artery embolization trials on practice, procedural pearls and pitfalls, and the potential for the future.

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How have the results of the new middle meningeal artery (MMA) embolization trials changed your subdural hematoma (SDH) practice?

Dr. Arthur: We have clear and convincing scientific evidence for the benefit of embolization in the treatment of symptomatic patients with chronic SDH. This therapy appears to be useful both as an adjunct to standard surgical drainage and as a stand-alone intervention.

Dr. Davies: The EMBOLISE trial demonstrated that there was a threefold reduction in recurrence rates for surgical patients receiving adjunctive embolization with Onyx (Medtronic). Based on that, we are embolizing our surgical patients. We are still awaiting completion of the observation arm of the trial, and because the other trials (ie, STEM and MAGIC-MT) were not independently powered to detect outcome differences for surgical versus observation cohorts, we continue to actively screen and enroll in the observation arm of the trial. If we see similar results in the observation cohort, I believe that we will be doing surgical interventions on fewer patients overall and embolizing more. The other element that remains uncertain is if we can accurately select for patients who are more likely to benefit from embolization. Those subanalyses are ongoing and will benefit from combining data across trials.

Dr. Inoa: In our practice, we're confident in the new evidence supporting MMA embolization as an

adjunctive treatment for chronic SDH. Recently, eligible patients underwent routine screening and randomization into a clinical trial. With three positive randomized trials backing MMA embolization, our threshold for offering this treatment has significantly decreased. The benefits are clear, with a marked reduction in failure/retreatment rates compared to traditional strategies. These data are invaluable for counseling patients and families about the procedure's benefits and for better estimating potential complications.

What are some pearls and pitfalls that need to be emphasized for the procedure?

Dr. Davies: Safety is key. The most serious embolization-related complications come from feeders that go to the eye or the petrosal branch that feed the geniculate ganglion. Ideally, embolization should remain above the level of the orbit to avoid both of these areas of concern. We don't yet know what constitutes a minimally adequate embolization, but trying to achieve good distal penetration does have early data to support faster rates of resorption. Again, these subanalyses are ongoing.

Dr. Inoa: Our aim is to safely embolize the frontal and temporal/parietal MMA branches. Ensuring optimal access and support is crucial for navigating through sometimes twisty MMA branches. In our practice, we prefer transfemoral access unless a vessel imaging study suggests otherwise. This is because older patients, who are more often affected by this condition, may have challenging anatomy for radial access. Because most patients don't have a vascular study before their procedure, we usually start with femoral access, which provides more flexibility if carotid access is difficult. Additionally, the safety profile of the procedure is reassuring. Positioning the microcatheter very distally is crucial, with particular attention to potential reflux to collateral branches.

Dr. Arthur: Both the safety and efficacy of the procedure are improved by getting distal microcatheter positioning, well up over the convexity. Because the anatomy of the MMA is highly variable, this is easy in some individuals and very difficult in others.

Although I believe that many different approaches will prove to be successful eventually, it makes sense that a more complete embolization of the pathological membranes themselves rather than the MMA will improve effectiveness.

What are future applications of MMA embolization?

Dr. Inoa: The trials are practice-changing—their presentation provided us with valuable insights into the safety and effectiveness of the MMA embolization procedure. However, we anticipate further follow-up data, especially with a combined analysis of the studies. We look forward to further knowledge that will enhance our understanding of patient selection, treatment criteria for MMA embolization as standalone versus adjunctive treatment, procedural timing, and choice of embolic agents, among others. Thanks to the outstanding work of our colleagues, the results of these trials will lead to the routine performance of minimally invasive procedures to treat a very prevalent condition with low morbidity and high success rates.

Dr. Arthur: There isn't any evidence yet that this treatment should be pursued for patients who are asymptomatic. There isn't any evidence yet that this treatment offers any benefit for patients with acute SDH. Both of these areas require further research.

Dr. Davies: There are some mixed data around the involvement of the MMA in certain migraine syndromes. Migraine impacts a huge proportion of the population, and thus, it is attractive to think that we may be able to use a similar technique to what we have shown to be safe and effective for SDH. Small-scale studies are underway to look at this possibility. ■

Disclosures

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Dr. Davies: Consultant to and advisory board for Medtronic, MicroVention, Imperative Care, Xenter, RapidPulse, Canon, and J&J; research grants from NIH R21/R01, NSF SBIR, UB-CAT, Buffalo Translational Consortium, Cummings Foundation, nVidia, and Google; financial interest for QAS.ai, Rist Neurovascular, Cerebrotech, Synchron, and Hyperion; and national PI/steering committees for StrokeNET DSMB, EMBOLISE, SUCCESS, RapidPulse, SBIR/STTR, NIH NINDS/NLM study sections.

Dr. Inoa: Consultant to Cerenovus, Johnson & Johnson, Corindus, Siemens, Medtronic, Covidien, MicroVention, Penumbra, Stryker, and Viz.ai.