

# CV Section News

## Chairman's Message

Editor: Carlos David, MD  
Co-Editor: Ketan Bulsara, MD



As my term in the role of Chair draws to a close at the AANS Annual meeting, I have had occasion to reflect on the accomplishments of our Section over the last year, and am proud to provide a brief report on some of our recent activities.

Firstly, it has been a pleasure and honor to work with the passionate and committed members of our Executive

Council and our membership over the course of the year. A heartfelt thanks to our Secretary Sean Lavine, Treasurer Brian Hoh, Vice Chair Bob Carter, Chair Elect Robert Friedlander, Past Chair Sander Connolly and our Members at Large Carlos David, Kevin Cockroft and Bernard Bendok, in addition to our Annual CV section Meeting Chair, Ketan Bulsara. There are many individuals who have donated their time and efforts in support of our specialty, serving on committees, providing guidelines reviews, representing our interests in national forums etc, too many to list all individually in a brief report. Nevertheless, I would extend my own, and the Section's, deepest gratitude for your involvement and efforts.

### Guidelines

The Section has remained very active in the arena of clinical practice guidelines. We first established a relationship with the Scientific Statement Oversight Committee (SOC) of the American Heart Association/American Stroke Association (AHA/ASA) in 2009. At that time, as then Chair of the CV Section Guidelines Committee, I became the first AANS/CNS liaison to the SOC, and our ongoing organizational communication and relationship has been incredibly productive. For any

guidelines projects commissioned since our involvement, we have had the opportunity to review and provide feedback with the goal of ultimate endorsement, as well as to assign designated writing committee members. Recent work products include the AHA/ASA Acute Ischemic Stroke Guidelines; although commissioned prior to our relationship with the SOC, we did have the opportunity to endorse the document after thorough review and feedback by an AANS/CNS Joint Guidelines Committee group led by J Mocco. Other AHA/ASA documents in the pipeline with current writing group representation from the CV section included Guidelines for Secondary Prevention of Stroke, Guidelines for the Primary Prevention of Stroke, Guidelines for the Management of Spontaneous Intracerebral Hemorrhage, Diagnosis and Management of Cervical Artery Dissections, Palliative and End of Life Care in Stroke, Guidelines for the Prevention of Stroke in Women, Guidelines for the Management of Unruptured Intracranial Aneurysms, Inclusion and Exclusion Criteria for IV TPA, and Recommendations for Management of Cerebral and Cerebellar Infarction with Swelling. I have been also pleased to hand over the reins of the CV Section guidelines committee to Kevin Cockroft, who now chairs a Committee of over 20 actively participating members.

### Patient Advocacy and Response

Among a number of our advocacy positions has been the CV section led response to the Joint Commission regarding the Comprehensive Stroke Center (CSC) requirements released last fall. These indicated a woefully inadequate procedural target volume for subarachnoid hemorrhage, and called for only 10 aneurysm cases to be treated annually by clipping OR coiling to qualify for CSC status. These numbers fall well below what would be considered optimal based on volume-outcome literature, and essentially sanctioned the lack of either clipping or coiling expertise by avoiding establishment of procedure specific volumes.

Furthermore no procedural minimums were defined for endovascular acute stroke intervention. In conjunction with our parent organizations and the American Academy of Neurology (AAN), the American Board of Neurological Surgery (ABNS), the Society of Neurological Surgeons (SNS), the Society of Neurointerventional Surgery (SNIS), and the Society of Vascular Interventional Neurology (SVIN), a multisocietal letter outlining the justification for amendment of the CSC criteria was sent to the Joint Commission in January. Further response is pending a Technical Advisory Panel determination expected in April. This matter will remain a high priority for the CV section and the newly formed Cerebrovascular Coalition (CVC) representing the AANS/CNS, CV Section, American Academy of Neurology (AAN), American Society of Neuroradiology (ASNR), the Society of Neurointerventional Surgery (SNIS), and Society of Vascular Interventional Neurology (SVIN) until a resolution can be obtained.

Another arena where the Section has taken an active lead relates to the recent publication of a trio of acute stroke intervention trials published in the *New England Journal of Medicine*: IMS-3, MR RESCUE and SYNTHESIS, ostensibly touted as failing to support the role of endovascular intervention for acute stroke. A detailed and thoughtful commentary analyzing the true implications of these trials has been compiled by a CV section writing group led by Alex Khalessi and J Mocco, and provides much need perspective to the appropriate interpretation of these studies as relates to patient care, and to reimbursement. The commentary, endorsed by our parent organizations, is scheduled for on-line publication within the coming week. Along these lines, the Section will continue active involvement with the Cerebrovascular Coalition (CVC), to which Nick Bambakidis and Kevin Cockroft serve as our official liaisons. This coalition of neuro-focused societies is well positioned to tackle a number of important issues of common interest.

#### Annual Meeting

This year the CV section Annual Meeting was held in collaboration with the SNIS, in beautiful Honolulu Hawaii. I will not elaborate given that the

highlights will be summarized by our CV Section Meeting Chair, Ketan Bulsara, in a separate report, but will only comment that the content, discourse and format made for an outstanding scientific meeting. The meeting was very well attended, with over 500 registrants, and proved to be financially successful. A brief survey of the membership following the meeting expressed strong support for the format and elements, and our current Scientific Program Chair, Nick Bambakidis has already begun preparations for next year's program in conjunction with SNIS, to be held immediately prior to the International Stroke Conference (ISC) in San Diego.

#### Endovascular Training

With anticipated changes in the structure of neurosurgical residency, including the move toward enfolded fellowship training, we have turned attention to re-examining pathways to ensuring robust training in the endovascular arena. This effort is all the more important in light of the expansion of fellowships throughout the country, training neurosurgeons, neurologist and radiologists, but without common enforced standards. Although ACGME has offered accreditation for Endovascular Surgical Neuroradiology for some years, the implicit requirement for the fellowship training to be post-residency (rather than enfolded), amongst other factors, has limited widespread adoption. Alternatively, the Society of Neurological Surgeons (SNS) Committee on Accreditation of Subspecialty Training (CAST) offers a pathway to accredit endovascular fellowships. In conjunction with program accreditation, the SNS is now also developing a process which would culminate not only in accreditation of the program, but also provide a mechanism to certify individuals who successfully meet the subspecialty specific training requirements. Recognizing the importance of standardized training across other specialties, as well as our own, the CV section has been engaging the Society of Neurointerventional Surgery (SNIS) and Society of Vascular Interventional Neurology (SVIN) leadership in an effort led by Adnan Siddiqui. We are encouraging participation in a joint effort to establish common standards for training to harmonize such elements as procedural minimums, competency milestones, and

certification examinations. Despite these ongoing efforts, I was disappointed to see a recent editorial appearing in the SVIN newsletter labeling Neurosurgery as disingenuous in its efforts to provide pathways for robust training in endovascular, and espousing the supremacy of ACGME post-graduate fellowship training. Needless to say, the SVIN endorsed pathway would impose post-graduate requirements which anyone would be hard pressed to defend as necessary in the face of enfolded, competency-based, CAST approved subspecialty training within an already 7 year program of neurosurgical residency.

#### Maintenance of Certification (MOC)

Although the American Board of Neurological Surgery (ABNS) offers a single certificate for Neurosurgery Board certification, the future direction in maintenance of certification may offer the option of participating in a focused practice MOC process. This would involve, among other subspecialty focused elements, a CV focused MOC examination. The CV section strongly supports this move, and in an effort led by Bernard Bendok, a committee has been convened to generate subspecialty focused questions for the MOC, in order to establish a vascular module to the MOC written examination. It is anticipated, furthermore, that subspecialty focused educational materials geared toward MOC would also be developed with the input of the Section.

#### Website

In order to keep pace with the needs of our membership, providing information and connectivity, the Section has invested in a redevelopment of the CV section website. This effort, led by Website Committee Chair, Greg Zipfel, will not only update the look and feel of the site but markedly enhance functionality, provide access to new features and function as a portal for CV related communications. The site is now in final development stages, with initial testing to proceed this Spring, and plans for full deployment within a few months. Much credit is due to the Website Committee members who have donated their time and expertise into developing the content and format.

In conclusion, it has been an honor and privilege to serve in the role of CV section Chair. Despite our efforts, much remains to be accomplished and the CV section must remain engaged and ready for challenges still to come. With our energetic and cohesive membership, I am confident that we are well poised to do so.

*Sepideh Amin-Hanjani, MD FAANS FACS FAHA*

# Secretary's Report

The AANS/CNS Section on Cerebrovascular Surgery is proud to continue our efforts to be the neurosurgical voice in the rapidly evolving development and delivery of open surgical and endovascular management of cerebrovascular disease. Our primary goal has been to



advocate for cerebrovascular patients and specialists as a collective voice of roughly 500 members and 1400 resident members guided by our executive council. The current Chair is Sepi Amin-Hanjani; Chair-elect, Robert Friedlander; Immediate-past chair, E. Sander Connolly; Vice-Chair, Bob Carter; Secretary Sean D. Lavine; Treasurer, Brian Hoh; Members at Large Kevin

M. Cockroft, Carlos David, and Bernard Bendok; Nominating Committee Members Adnan Siddiqui and Andy Ringer; and Membership Chair Greg Zipfel. Our Executive Council is over 50 members strong serving multiple committees and representatives to adjunct groups. We hold open nominations and elections for our officers in the Executive Council. Our work includes policy development, education, research, and collaboration with numerous organizations and specialists focused on cerebrovascular disease.

We have been honored to serve with our current Chair Sepi Amin-Hanjani over the past year. Sepi has been an outstanding leader, incredibly devoted to the organization and the field of cerebrovascular surgery. Her energy and attention to detail are unparalleled, and neurosurgery and our patients are fortunate to have her strong voice advocating for our ever-changing field.

Our recent activity in policy development has focused on re-organizing angiography CPT Coding with the Society of Interventional Radiology the AANS/CNS Coding and Reimbursement Committee. This has lead to a major change in coding mandated for many unbundled procedures. Every attempt was made to maintain accuracy and valuation for these common procedures.

Our Rules and Regulations Committee headed by Charlie Prestigiocomo is continuously modifying our by-laws to properly represent the Society. The manner in which members are approved to the CV Section has recently been streamlined and is currently undergoing by-laws modification.

Active policy development issues also include an aggressive response to the recent lowering of standards for Comprehensive Stroke Center Certification by the Joint Commission lead by Sepi Amin-Hanjani who also formulated a response to the COSS Trial publication. Additionally, through the efforts of Andy Ringer and Peter Rasmussen, we have responded to the FDA regarding the Wingspan Stent System for Intracranial Atherosclerosis recall. The CV section is beginning organization of an ad hoc committee to develop a cerebrovascular module for the N2QOD project. Our recently completed response to the publication of three major stroke intervention trials will soon be published. The development of a Rapid-Response Committee under the guidance of Dr. Amin-Hanjani will enable our Section to quickly and appropriately address all of the significant developments in cerebrovascular surgery.

We collaborate with the Society of NeuroInterventional Surgery (SNIS), Society of Vascular and Interventional Neurology (SVIN), Neurocritical Care Society and United Council of Neurological Subspecialties, the (Senior) Society of Neurological Surgeons (CAST System Matrix/Milestones projects), and the [Brain Aneurysm Foundation](http://www.bafound.org) (<http://www.bafound.org>) to educate and advocate for neurosurgeons and our patients. We now have a reciprocal liaison arrangement with the SVIN, allowing for improved communication and collaboration with our interventional neurology colleagues. We have also recently re-established a partnership with the SNIS and held an enormously successful joint venture with them at our Cerebrovascular Section Annual Meeting in Honolulu, Hawaii Feb 3-5, 2013. The CV Section Meeting immediately preceded the AHA International Stroke Conference, which the Section co-sponsors and controls a major component of the scientific program with three neurosurgical members on the program committee.

We continue to hold an annual Endovascular Practicum, offering neurosurgical residents and fellows the unique opportunity to interact directly with



neuroendovascular faculty and industry with both didactic and "hand-on" training with the latest technology. A full day course had been previously been offered the day before the CV Section Meeting allowing for formal and informal interaction between the leading endovascular faculty and trainees with the goal of inspiring careers and exposing individuals to additional perspectives. The courses have been successful beyond expectations and plans are in place to continue and expand the opportunity. The course will be held at the AANS in New Orleans this year and is directed by Drs. J Mocco and Adam Arthur.

At the AANS and CNS annual meetings, the Section continues to sponsor multiple symposia and poster sessions including several exciting lectures by noted authorities. The Donaghy and Yasargil Lectureships are given annually at the AANS meeting and the Drake Lectureship is given at the CNS. We are also actively involved in the CNS University continuing to support Webinars and the image repository under the guidance of Bernard Bendok.

In 2012 (September 21-23) we held a Joint Meeting with the Cerebrovascular Society of India in Mumbai. This proved to be a delightful experience for those of us that attended, and was a fruitful exchange of ideas and cultural experiences.

The Cerebrovascular Section actively supports research. We sponsor the Resident Research Fellowship Award in Cerebrovascular Disease and awards Top Research Prizes in Cerebrovascular Disease at the Cerebrovascular Section, CNS, and AANS annual meetings. The Resident Research Award program has successfully funded resident researchers over the last 10 years and has recently been renamed the Robert J. Dempsey Resident Research Award Program in recognition of his guidance and efforts in maintaining this important program. Through these initiatives, the Section is dedicated to helping attract the best and brightest into a career in cerebrovascular surgery.

Our website: <http://www.cvsection.org/> is constantly being improved under the tutelage of Greg Zipfel and Bob Carter. These improvements include a new feature to follow the Section at [twitter.com/cvsection](https://twitter.com/cvsection), and to post moderated tweets to section members by sending an email to [tweet@cvsection.org](mailto:tweet@cvsection.org). The website also

provides the ability to post biographical information on the public page of the website. We are currently in the process of finalizing a new design with a professional company to completely revitalize the website.

The CV Section is a vital, dynamic, progressive organization committed to adapting to the changes in the treatment of patients with cerebrovascular disease. We encourage all neurosurgeons and cerebrovascular practitioners to become involved in our educational, research and advocacy activities. It is only through the efforts of dedicated individuals that we will continue to provide these important opportunities.

*Sean D. Lavine, M.D.*

*Secretary, AANS/CNS Cerebrovascular Section.*

## TREASURER'S MESSAGE

*Brian Hob, MD, PhD*

I am happy to report that the Joint Cerebrovascular Section is in excellent financial standing. The JCVS/SNIS Joint Annual Meeting in Honolulu, Hawaii was a success both scientifically and financially. Thus far in FY 2013, we are ahead of budget. Our net assets have been stable due to success with our long-term investment pool. A special thanks should go to Ray Turner, MD for raising corporate sponsorship to fund the Robert Dempsey Resident Awards in Cerebrovascular Research. This year, the JCVS took on a significant project investment by contracting with an outside vendor to create and maintain a JCVS website. As in previous years, the JCVS has contributed \$10,000 to the Washington Committee, and \$20,000 to the AANS NREF.

In May, my three-year term ends as Treasurer, and I would like to express my sincerest gratitude for the opportunity to serve the JCVS in this role.

**SPECIAL ANNOUNCEMENT:**

NIH has just published RFAs for the National Coordinating Center and the Regional Coordinating Sites for the newly approved NINDS Stroke Trials Network. This clinical network will provide infrastructure and intellectual capital for prevention and recovery research, as well as acute treatment research. Involvement of vascular neurosurgery in the network is critical for building the evidence base for innovative procedures that improve patient outcomes. The CV Section encourages you to review these RFAs with your institutional collaborators. Below are the links to these funding announcements:

[RFA-NS-13-011: NINDS Stroke Trials Network - Regional Coordinating Stroke Centers \(U10\)](#)

[RFA-NS-13-012: NINDS Stroke Trials Network - National Clinical Coordinating Center \(U01\)](#)

## ANNUAL MEETING SUMMARY

*Ketan Bulsara and Don Heck*

The 2013 annual cerebrovascular section meeting was held in partnership with the Society of Neurointerventional Surgery in Honolulu, Hawaii February 3rd-5th. This was a first time endeavor. This year we also welcomed our colleagues from the Mt. Bandai Symposium Neuroscience/Pan-Pacific Neurosurgery Conference. Including the preconference workshop and the meeting, we had over half a thousand participants and over 188 submitted abstracts. Based on a post-meeting survey conducted by the cerebrovascular section, the meeting and its format were well received.



The preconference workshop focused on the Socioeconomics of Neurovascular Care and Nuances in the Management of Complex Vascular Lesions: Tricks and Pitfalls. Competing with both the beautiful weather of Hawaii and the Superbowl, both these sessions had excellent attendance.

The official meeting began with Dr. Jacques Morcos and Dr. Michael J. Alexander moderating the panel discussing Cerebrovascular Controversies. This led to excellent discussions and frequent

disagreements highlighting many of the controversies in our specialty. This day also featured the CV section chair, Dr. Sepideh Amin-Hanjani address, and the Luessenhop Lecturer, Dr. Ling Feng who spoke about Revascularization in China. The Resident Synthes abstract award recipient was Dr. Bradley Bohnstedt who presented on E-aminocaproic Acid Use Prior to Endovascular Treatment of the Ruptured Cerebral Aneurysm. One of the highlights of the first day was the Moya Moya session moderated by Dr. Chang Wan Oh and Dr. Gary Steinberg that featured many of our Asian colleagues discussing their treatment philosophies and concerns in the treatment of this common disorder for them.

The second day began with presentations addressing the role of endovascular therapies in the management of acute stroke. These were excellent presentations that highlighted the ongoing debates regarding the future of endovascular stroke therapy. This day also featured the SNIS president, Dr. Michael J. Alexander's address and highlighted issues in microsurgical/endovascular revascularization and delayed cerebral ischemia/cerebral vasospasm.

As co-chairs of the meeting this year, Don Heck and I were fortunate to be able to work with an excellent joint planning committee. Members of this committee included Nicholas Bambakidis, J Mocco, Peter Nakaji, Blaise Baxter, Kristine Blackham, Michael Hill, Shazam Hussain, and Adnan Siddiqui. The members of the abstract review team did a tremendous job in reviewing over 188 abstracts in a very short time frame. These members included Ali Alaraj, Blaise Baxter, Kristine Blackham, Chirag Gandhi, Michael Hill, Shazam Hussain, Charles Matouk, Aditya Pandey, Andrew Ringer, Adnan Siddiqui, Ajith Thomas, Stavropoula Tjoumakaris, and Babu Welch.

## TECHNICAL FORUM: MICROSURGERY FOR BRAINSTEM CAVERNOUS MALFORMATIONS

*BY KETAN R. BULSARA, MD*

In 1928, Walter Dandy first removed a brainstem cavernous malformation from the pontomedullary junction of a 21 year old patient. Long after his time, such feats were considered unimaginable due to the significant morbidity and mortality associated with these operations. Yet with improvements in imaging capabilities and refinement of microsurgical techniques, microsurgery for brainstem cavernous malformations are now an important consideration in carefully selected patients. It is no surprise that this topic still endears treatment philosophy debate, not only between major medical centers, but also within accomplished cerebrovascular neurosurgeons within the same institution.

In a recently published paper that combined 68 surgical series for a total of 1390 patients, subgroup analysis further sheds light on the high risk nature of this operation <sup>1</sup>. Though there are limitations in this study, some interesting numbers do arise. Complete resection of the cavernomas was achieved in 91% of cases. In the case of incomplete resection, the rebleed rate can be as high as 65%, probably no better than the variably reported natural history. Early neurological morbidity after surgery was 45%. Long term, however 84% of patients had improved or stayed the same with no further risk of bleeding. Sixteen percent, however, worsened. The combined mortality across these series was 1.5%.

Brainstem cavernous malformations with a repeated history of hemorrhage are no doubt treacherous lesions that without treatment will likely devastate the patient leading to significant morbidity and mortality. Microsurgery offers a chance to cure these lesions, but the risks are significant. It may, however, be the only chance to prevent the devastating natural history in carefully selected patients.

For this technical forum, perspectives on microsurgery for these lesions, focusing on timing of surgery are presented by Dr. Michael T. Lawson (UCSF); Dr. Peter Nakaji, Dr. Joseph M. Zabramski, Dr. Robert F. Spetzler (BNI); and Dr. Helmut Bertalanffy (Hannover, Germany).

1. Gross BA, Batjer HH, Awad IA, Bendok BR, Du R. Brainstem cavernous malformations: 1390 surgical cases from the literature. *World Neurosurg.* 2012



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## Timing of Surgery in Brainstem Cavernous Malformation

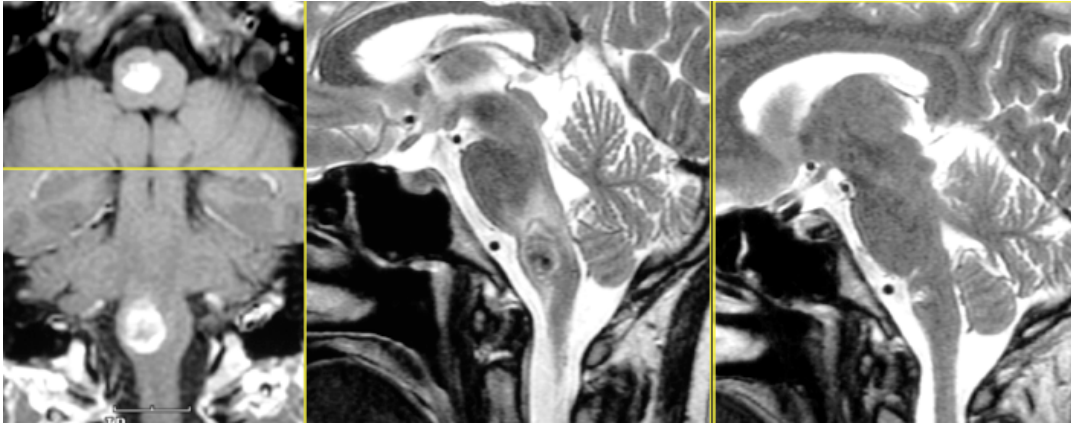
**Helmut Bertalanffy**

As far as I can estimate from many discussions during local and international meetings, there is a tendency among neurosurgeons to avoid early surgery for brainstem hemorrhages from cavernomas and, instead, favor postponing the microsurgical procedure for at least 3 or 4 weeks after the hemorrhage. The main argument quoted for such a decision is the necessity of protecting the compressed or edematous parenchymal tissue of the brainstem from damage by direct surgical manipulation. One can note that such statements are not always based on the personal experience of the presenter, but sometimes rather on information obtained from pertinent publications. Indeed, the literature of the 1980s and 1990s most often recommended initial conservative treatment after brainstem hemorrhage. It reflects the policy of the early period when high resolution imaging was not yet available and worldwide only few neurosurgeons began treating these challenging brainstem lesions surgically, thus penetrating into what was previously considered a “no man’s land”. Later, this policy was simply adopted by many others as can be observed in the pertinent literature of the following years.

Interestingly, at most occasions when such discussions arose what was missing was the extent of a patient’s symptoms in correlation with the brainstem hemorrhage. However, I consider this the most important criterion for decision-making apart from the morphological situation, the patient’s age, co-morbidity etc. I definitely do not agree with the opinion of some colleagues that try to propagate the delayed surgery in brainstem cavernoma as a rule of the thumb, although it may be an alternative in certain cases. We should look at this matter from our present perspective and in the context of modern neuroradiological imaging that provides all morphological details needed for proper decision-making. My policy since for many years is to evacuate an acute brainstem hemorrhage of significant volume caused by a cavernoma as early as possible, particularly when the clinical condition of the patient is progressively worsening after the bleeding episode. Conversely, there may be occasions when we encounter patients presenting with a huge brainstem hematoma on MRI but clinically with only mild symptoms. Such discrepancy between hemorrhage size and clinical implication can be observed in children as well in adults when the hematoma develops extremely slowly. However, these are not the typical representative but rather exceptional cases. In such instances, and generally in all patients with mild symptoms that do not worsen over the following days after an initial bleeding, I would wait and repeat the control MRI. It may well be possible that the hematoma size will gradually decrease over time. Such patients can certainly be managed conservatively and may not need surgery at all. I have managed an entire patient series with such a policy.

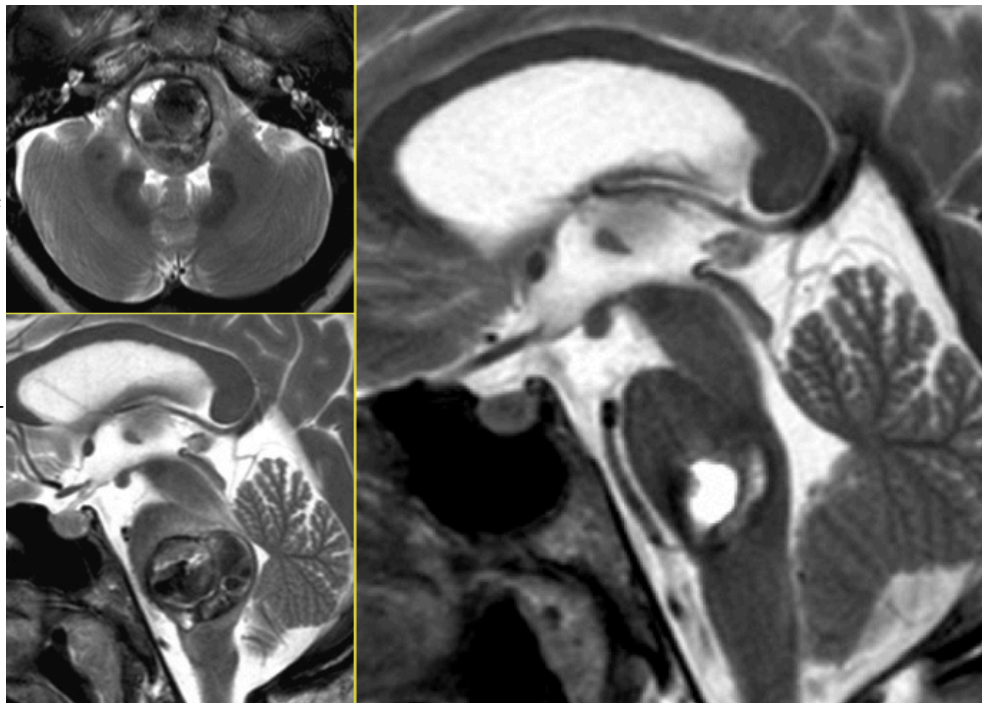
We should bear in mind that the pathomechanism of a cavernoma bleeding is quite different from other types of brain hemorrhage, particularly from those caused by ruptured aneurysms or AVMs. In the vast majority of cases the cavernoma bleeding is intralesional and thus encapsulated. It expands at least over hours, more often over days and rarely induces a sudden disruption of the parenchymal tissue, at least in the early phase. Symptoms are caused by the compressive effect on local structures such as long-tract fibers and brainstem nuclei and by the progressively impaired local microcirculation. This pathomechanism may be enhanced by a perilesional edema (Fig. 1). In many instances the edema increases over the following days, which is worsening the situation. Needless to say that this is always reflected in a deteriorating clinical picture. Why then wait in such an acute and dangerous situation that threatens the patient’s health or, albeit rarely, even his life, and may eventually lead to permanent neurological deficits? It is obvious that interrupting such a progressive worsening course with an early surgery will rapidly release the local pressure, and, consequently, adds to restoring the local microcirculation, which is paralleled by a dramatic clinical improvement. I have observed this scenario in numerous cases and the success of this management is convincing. By using proper technique that implies an optimal surgical approach to the involved part of the brainstem, a minimal opening of the brainstem at a site

sometimes described as “safe entry zone” and minimal manipulation within the hemorrhage/cavernoma cavity, it is possible to evacuate even extremely large lesions without additionally damaging the brainstem (Figs. 1 and 2).



When discussing the timing of surgery in brainstem cavernomas, we should also outline the general indication for surgery and clearly define the type of the underlying brainstem hemorrhage, not only morphologically as seen on MRI but also clinically. The latter is perhaps the most misleading point. The term “brainstem hemorrhage” is used for too many types of bleeding (acute, subacute, old, etc.), and may sometimes be applied even to simple hemosiderin deposits within the brainstem, which has nothing in common with a space occupying and clinically threatening bleeding.

To summarize, a brainstem hemorrhage from a cavernoma should always be described not only morphologically, referring to its size, location and extension etc., but also in the clinical context over a certain time period, referring to the severity and the behavior of the clinical picture. In case of mild symptoms that do not worsen during the days or even weeks after the bleeding episode, and in the absence of repeat hemorrhage, a “wait-and-control-policy” may be a valid method of managing the patient, particularly in individuals aged 50 years or more. Surgery, if really needed, can well be done in such cases at a later stage without detriment for the patient.



The indication for surgery in children or young adults should be established more strictly, as the rate of re-bleeding can be quite high. If it turns out that the hemorrhage is already the second or repeated episode, surgery might be the best treatment option. The timing of the surgical procedure should depend upon the clinical situation and its development over time. Early or even emergency surgery is always indicated when the patient is rapidly and progressively deteriorating.

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## **Surgical Timing with Brainstem Cavernous Malformations**

Mike T. Lawton MD

Timing of surgery for brainstem cavernous malformations depends on three factors: symptomatic hemorrhage, surgical accessibility, and time interval from the bleeding.

Hemorrhage from brainstem cavernous malformations invariably produces symptoms. In general, there are no asymptomatic hemorrhages in this exquisitely sensitive area. Therefore, patients typically present with a bleeding event and the timing is usually right to recommend surgery. Those that present with incidental brainstem cavernous malformations are typically intact with everything to lose, and they are best managed with conservative observation. In between are the patients who have a remote history of a symptomatic hemorrhage, but have recovered to normal or near normalcy. Timing of surgery in these patients is less clear, and depends on the degree of recovery and the patient's level of concern.

Surgical accessibility is essential for surgery. It does not matter that a patient is devastated by hemorrhage and emotionally ready for surgery if the lesion is buried in the brainstem without surgical access. Surgical accessibility means that the lesion is on a pial or ependymal surface, there is a good surgical approach to that surface, and the operation will not make the patient worse. Surgical approaches for brainstem cavernous malformations are limited, and some lesions can be paired with an acceptable approach while others cannot. For example, the lateral supracerebellar-infratentorial approach is perfect for lesions in the posterolateral midbrain, and similarly the far lateral approach is perfect for lesions in the posterolateral medulla. However, there are no good approaches for anterior midline pontine lesions. Our job as neurosurgeons is to analyze the lesion with all its unique anatomy, choose the best surgical exposure, and fairly estimate the risks. Observation is the other management option, and therefore we must also estimate the natural history risks. It is then up to the patient to make the decision for or against surgery. It is important to remind patients who decide against surgery that things may change. An operable lesion presenting with a minor hemorrhage may represent with a devastating hemorrhage. An inoperable lesion may become operable with a new hemorrhage that reaches a surgically accessible surface. Therefore, surgical decisions may have a long timeline that requires active patient follow-up.

Finally, the time interval from the bleeding is an important factor. First, bleeding in the brainstem induces edema that softens the tissues and makes circumdissection riskier. Firmer tissues without edema and with some gliosis are easier to dissect. Second, the hematoma itself can help separate the malformation from the brainstem as it liquefies. Even hematoma that liquefies within the lesion's capsule is helpful because its evacuation creates intralesional room for resection. The optimum time window is 2 – 8 weeks after the hemorrhage. With further delay, liquefied clot reabsorbs completely and thick scar tissue adheres the malformation to the brainstem.

The decision to proceed with surgery for brainstem cavernous malformation should not be taken lightly. Surgical timing is an important variable that make a real difference in patient outcomes. Just as the vintner knows the right time to uncork his wine, the neurosurgeon should carefully plan the right time for these challenging resections.

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**Decision-Making and Timing of Surgery for Ruptured Brainstem Cavernous Malformations**

Peter Nakaji, Joseph M. Zabramaski, Robert F. Spetzler

Cavernous malformations are low-pressure abnormal vascular lesions arising from disordered capillary tissue. They are prone to cause repeated hemorrhages of varying severity. They may arise anywhere within the brain, and appear to do so at a fixed rate per volume. However, they are more frequently come to clinical attention in eloquent regions such as the brainstem, where even a small hemorrhage may be symptomatic. Although a few small series have proposed radiosurgery as a primary treatment, the evidence to support this mode of treatment remains slim. Therefore, microsurgery remains the mainstay of treatment.

When patients present acutely with a ruptured cavernous malformation in the brainstem, the surgeon is faced with two options. The lesion can be observed or it can be operated on and removed. Only complete removal provides protection from further bleeding. The decision whether or not to operate depends on the condition of the patient, the symptomatology, size of the hemorrhage, the specific location of the hemorrhage, and the approach required. Cavernous malformations considered for conservative management and observation rather than surgery include those in patients who are poor candidates for surgery from a medical standpoint and those with small hemorrhages deep within the midbrain, pons, or medulla where the approach itself is felt to carry a high risk of operative morbidity. Most ruptured cavernous malformations, including those which are highly symptomatic, presenting with larger hemorrhages, and with repeated hemorrhages, will be treated surgically. The decision about how many hemorrhages to tolerate before choosing surgery is somewhat subjective. Since deficits associated with hemorrhages are cumulative and each usually recovers only partially, it may be in the best interest of the patient to have surgery rather than tolerate repeated hemorrhages.

When faced with a recent hemorrhage, there is no level I or II evidence-based guidance as to when the best timing for surgery is. However, a rational schema exists for decision-making. Patients with large hemorrhages with significant mass effect are taken to the operating room expeditiously. This provides rapid relief of mass effect and mitigates secondary injury. Others are generally taken to the operating room a few days after the clinical hemorrhage. Taking a patient relatively early after a hemorrhage takes advantage of the fact that the blood clot has generally partially dissected the cavernous malformation from the parenchyma of the brainstem, facilitating resection. With a delay of a few days, the blood itself generally has also liquefied somewhat, making removal of the clot itself easier. Once two weeks or more has passed, the clot will have been absorbed, making the removal more similar to elective removal in an unruptured patient. This is a less advantageous time in that the malformation must be dissected away from the brainstem on all sides instead of hematoma, and also because the patient must endure both the recovery from the initial hemorrhage and the recovery from the surgery.

Safe corridors to most parts of the brainstem exist to facilitate removal of brainstem cavernous malformations. Nonetheless, as many as 50% of patients will suffer some new deficit related to surgery. Fortunately, many of these are temporary. The process of removal should be considered by the patient symptomatically to be like another hemorrhage, except that it should be the last one. The rate of local recurrence is low, which further supports early removal. In the end surgeon's confidence in his or her own ability to achieve a complete and safe removal will weigh heavily in the decision-making.

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**OPPORTUNITIES FOR FUNDING****AANS FELLOWSHIP/GRANTS**

<http://www.aans.org/Grants%20and%20Fellowships.aspx>

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<http://w3.cns.org/education/fellowship2.asp>

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Chairman and The Manucher J. Javid Professor of Neurological Surgery

Department of Neurological Surgery

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