

Intracranial vascular stenosis treatment: Evidences in neurointerventional management

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Introduction

Strokes constitute a disease associated with a high grade of morbidity and mortality. Several stroke symptoms are associated with atherosclerosis disease which is an important predisposing factor in the cause of strokes.

Recommended stroke prevention includes lowering the intake of tobacco and decreasing cholesterol and hypertension.

There are doubts about treatment of asymptomatic intracranial atherosclerosis. In the mid-80s the recommended preventive revascularization was a by-pass between the superficial temporal artery and the middle cerebral branch artery. The achievement of a pilot multicenter investigation showed better results when combined with aspirin treatment. (1)

Following these results, surgery was consequently avoided for this disease. The development of new techniques, endovascular devices for superselective brain approaches, endovascular experience obtained in cerebral aneurysms and AVM's management, helped to develop a new approach in stroke treatment and stroke prevention. Cardiologist's experience with coronary illnesses helped to carry out similar experiments with cerebrovascular disease.

We will analyze four articles published during last year which constitute important advances in this interesting subject.

1) CURRENT STATUS OF THE MANAGEMENT OF SYMPTOMATIC INTRACRANIAL ATHEROSCLEROTIC DISEASE: THE RATIONALE FOR A RANDOMIZED TRIAL OF MEDICAL THERAPY AND INTRACRANIAL STENTING

Fiorella D, Turan TN, Derdeyn CP, Chimowitz M I .

J NeuroInterv Surg (2009). doi:10.1136/jnis.2009.000125 1 of 5

Information

This is a review about the natural history of symptomatic intracranial stenosis when treated medically, the available interventional therapies and the rationale for the design of the SAMMPRIS trial.

The subset of patients in WASID who presented with high-grade stenosis (70%) were at a much higher risk for recurrent stroke than those with lower grades (50–69%) of stenosis. This was particularly true of those who presented with

stroke. Patients presenting with stroke and high-grade stenosis had a 24.6% rate of ipsilateral stroke within 2 years of enrollment (in comparison to only 11.2% in those patients with lower-grade stenosis). For this reason, patients with high-grade stenosis represent a cohort who may benefit from more invasive treatments. Otherwise recurrent stroke usually occurs early—often within the first few days after the qualifying event.

Over interventional treatment options extracranial to intracranial by-pass for anterior circulation occlusive disease has been the most thoroughly studied. The patient subset with MCA stenosis had a considerably higher risk of stroke after EC–IC bypass (44%) in comparison to medical therapy.

There is no such an important study for Intracerebral balloon angioplasty as prospective, randomized, 1495-patient trial comparing extracranial to intracranial (EC–IC) bypass with medical therapy. The best reports show nearly half of the lesions with residual stenosis of 50% or more after the procedure and there is no PTA balloons approved by the FDA for use.

Angioplasty and stenting with balloon-mounted coronary stents has an incidence of in stent restenosis of about 30% and there are no commercially available balloon-mounted stents with a labeled indication for intracranial (SAMMPRIS) is a phase III, multicenter, randomized trial comparing aggressive medical management alone with aggressive medical management in combination with angioplasty and stenting using the Gateway–Wingspan system in patients with symptomatic, high-grade, intracranial stenosis.

The primary endpoint in the study is any stroke or death within 30 days of enrollment or ischemic stroke in the territory of the symptomatic artery from day 31 to study completion. The study will enroll a total of 764 patients to detect, with 80% power, a 5% relative reduction in the projected rate of the primary endpoint in the stenting group.

Analysis

This article takes information from WASID study (2) which was a prospective, randomized trial comparing warfarin and aspirin for preventing recurrent ischemic stroke in patients with symptomatic intracranial atherosclerotic disease with an intracranial stenosis of 50–99% verified on conventional angiography. The study had been stopped due to a higher rate of adverse events in the group treated with coumadin. This study provided a large, high-quality, dataset of patients with symptomatic ICAD who were treated medically. Based in this information the authors describe the rationale for the design of a study, named SAMMPRIS, which is a randomized trial comparing aggressive medical management alone with aggressive medical management in combination with angioplasty and stenting.

They make an extensive and complete description of all the alternative techniques published for the treatment of this disease. All the authors have NIH funding for the trial and it will be used only one stent system in the study.

2) FIRST FOOD AND DRUG ADMINISTRATION-APPROVED PROSPECTIVE TRIAL OF PRIMARY INTRACRANIAL STENTING FOR ACUTE STROKE SARIS (STENT-ASSISTED RECANALIZATION IN ACUTE ISCHEMIC STROKE)

Levy EI, Siddiqui AH, Crumlish A, Snyder KV, Hauck EF, Fiorella DJ, Hopkins LN, Mocco J
Stroke. 2009;40:00-00

Information

Based on numerous case series and many cardiac literature parallels we thought that acute stenting may yield high revascularization levels with low associated morbidity. We therefore conducted a trial approved by the FDA for prospective pilot trial to evaluate the safety of intracranial stenting for acute ischemic stroke in 2 centers (University at Buffalo, Cleveland Clinic) as a first-line intraarterial (IA) acute stroke treatment for 20 prospectively enrolled patients.

The device identified for evaluation was the Wingspan Intracranial SES System (Boston Scientific). The study was conducted between February and October of 2008.

Eligibility criteria included presentation 8 hours after stroke onset, age 18 years or older, NIHSS score more than 8, angiographic demonstration of focal intracerebral artery occlusion 14 mm, and either contraindication to intravenous tissue plasminogen activator or failure to improve 1 hour after intravenous tissue plasminogen activator administration.

Exclusion criteria included known hemorrhagic diathesis or coagulopathy, platelet count 100 000, intracranial hemorrhage, blood glucose level of 51 mg/100 mL, or CT perfusion imaging demonstrating more than one-third at-risk territory with nonsalvageable brain (low cerebral blood volume). Data are presented as mean SD. Twenty patients were enrolled (mean age of 63; 14 women). Mean presenting National Institutes of Health Stroke Scale was 14 +/- 3.8 (median 13). Presenting thrombolysis in myocardial infarction score was 0 (85% of patients) or 1 (15%). Recanalization to thrombolysis in myocardial infarction score of 3 (60% of patients) or 2 (40% of patients; P_0.0001) was achieved. One (5%) symptomatic and 2 (10%) asymptomatic intracranial hemorrhages occurred. At 1-month follow-up, a modified Rankin scale score of _3 was achieved in 12 of 20(60%) patients and a modified Rankin scale score of _1 was achieved in 9 of 20 (45%) patients. Food and Drug Administration-approved prospective study suggests primary intracranial stenting for acute stroke may be a valuable addition to the stroke treatment armamentarium.

Analysis

This is an important step for the increasing of the armamentarium of acute stroke disease. It consist of a short cohort of patients and is the first step of the evolution of a new type of approach to acute stroke. In this paper, the authors analyze the availability of stenting as a possible treatment for acute stroke. We need a multicenter and randomized trial allowing the use of stents as a definitive option for acute stroke asociated to intracranial vessel stenosis.

3) A SYSTEMATIC REVIEW ON OUTCOME AFTER STENTING FOR INTRACRANIAL ATHEROSCLEROSIS

Groschel K, Schnaudigel S, Pilgram SM, Wasser K, Kastrup A
Stroke. 2009;40:e340-e347.

Information

This is a systematic review to determine the immediate and long-term outcomes, as well as the durability of angioplasty and stenting of intracranial stenosis. This paper includes 31 studies written in English; with more than 5 patients with intracranial angioplasty and stent procedures in each one; patients with intracranial artery stenosis greater than 50%, determined on conventional angiography; and with periinterventional complications (stroke or death) reported. In case of multiple publications from the same study population with overlapping recruitment periods they used the most recent publication.

There were 1134 patients and 1177 arteries treated with a lower limit of stenosis of 50 to 80% nearly half of them from anterior circuit. The procedures were made through a self-expanding stent or through a balloon-mounted stent. The mean severity of stenosis before treatment ranged from 67% to 92% (mean \pm SD: 77.7 \pm 7.4) and from 0% to 38% (13.9 \pm 10.5) after treatment, respectively. Nearly half of them (48.5%) were located in the anterior circuit.

They observed a median technical success rate in 96.9% across all studies. Self-expanding stent showed more residual stenosis post-procedure than balloon-mounted stents.

They found 7.7% periprocedural minor or major stroke and death rates with more incidence in posterior circuit (12.1% versus 6.6%). There were no differences in complications between the two types of stents utilized.

There are some differences in restenosis rates between balloon-mounted stent (13.8%) and self-expandable stent (17.4%).

Otherwise, they described a high rate of restenoses, which appears to be higher after the use of self-expandable than after the use of balloon-mounted stents. The majority of adverse events occurs within the first few weeks after intracranial stent placement.

In the discussion, they compare the results with natural history evolution demonstrated in WASID study, showing a high incidence of morbidity associated to one center procedures (up to 50%) and a similar number of strokes events after one year of treatment.

The conclusion of this publication is that there is a high variability of morbidity associated to this procedures depending of the centers and that intracranial stent placement should only be performed in institutions with a high-volume number of procedures and we urgently need a comparative study between stenting and the best medical therapy in a prospective randomized trial.

Analysis

This is a systematical review of angioplasty and stenting of symptomatic intracranial stenosis to determine immediate and long term outcomes as well as the durability of the results of the procedures and an analysis of the impact of procedural and patient related variables on outcome.

An important limitation of this study is that the vast majority of data of intracranial stenting systems come from retrospective case series. Besides, only 14 of the 31 studies of this review have been published, which provide prospective data on long-term outcome after the procedure and up to date, there is no prospective trial which compare stenting versus best medical therapy. The short follow up of the series reviewed denies the possibility to observe the natural history after the treatment.

Since there is no quality selection of the series studied, there some variables, such as comorbidities associated to the patients and experience of the operators that of course influences in the effectiveness of the treatment, Stenting and angioplasty are different technics and perhaps they are not able to be compared. Different investigators compare an established and tested treatments as antiagregation versus new therapeutics technicals and probably is very to do a meta-analysis comparing this two types of technicals in development.

4) INDICATIONS FOR THE PERFORMANCE OF INTRACRANIAL ENDOVASCULAR NEUROINTERVENTIONAL PROCEDURES A SCIENTIFIC STATEMENT FROM THE AMERICAN HEART ASSOCIATION COUNCIL ON CARDIOVASCULAR RADIOLOGY AND INTERVENTION, STROKE COUNCIL, COUNCIL ON CARDIOVASCULAR SURGERY AND ANESTHESIA, INTERDISCIPLINARY COUNCIL ON QUALITY OF CARE AND OUTCOMES RESEARCH

Meyers PhM, Schumacher HCh, Higashida RT, Barnwell SL, Creager MA, Gupta R, McDougall CG, Pandey DK, Sacks D, Wechsler LR
Circulation. 2009; 119: 2235-2249

Information

The present document is a review about the current information and data for the efficacy and safety of all the procedures used for intracranial endovascular interventional treatment for cerebrovascular diseases and aims to provide recommendations for their use based on the best available evidence. The recommendations are classified by the American Heart Association (AHA) classification of recommendations and levels of evidence.

The literature review was made by a computerized search of the National Library of Medicine database of literature (PubMed) from 1966 to July 2007 with 2 goals: (1) To identify published neurological and intracranial endovascular cerebrovascular interventional outcome data that could be used as benchmarks for quality assessment; in addition, the process sought to identify those risk-adjustment variables that affect the likelihood of success and complications. (2)

To identify data that can be used as the basis for monitoring the appropriateness of performance of endovascular cerebrovascular procedures.

The recommendations for the procedures of interest for us, based on a deep analysis were: 4) Patients with intracranial stenoses should receive advice about lifestyle modification and treatment of atherosclerotic risk factors with statins, angiotensin-converting enzyme inhibitors, and antithrombotics as recommended by the AHA/American Stroke Association guidelines for secondary stroke prevention⁸⁵ (Class I, Level of Evidence A).

5) Endovascular revascularization by intravascular balloon angioplasty and/or stenting may be considered for patients with symptomatic severe intracranial stenoses (70% luminal narrowing) despite optimal medical therapy (Class IIb, Level of Evidence C).

6) Intra-arterial thrombolysis is indicated for treatment of selected patients with major stroke of ≤ 6 hours' duration due to an occlusion of the middle cerebral artery (Class I, Level of Evidence B).

7) Intra-arterial thrombolysis is reasonable for patients who have contraindications to the use of intravenous thrombolysis, such as recent surgery (Class IIa, Level of Evidence C).

8) The availability of intra-arterial thrombolysis should generally not preclude the intravenous administration of rtPA in otherwise eligible patients (Class I, Level of Evidence A).

9) Treatment requires the patient to be at an experienced stroke center with immediate access to cerebral angiography and qualified interventionists. Facilities should define criteria to credential individuals who can perform intra-arterial thrombolysis (Class I, Level of Evidence C).

10) Although the Concentric Merci device can be useful for extraction of intra-arterial thrombi in appropriately selected patients, the utility of the device in improving outcomes after stroke remains unclear (Class IIb, Level of Evidence B).

11) The usefulness of other endovascular devices is not yet established, but they may be beneficial. (Class IIb, Level of Evidence C).

Analysis

The authors of this paper are: 1) neurointerventionists with a broad range of practice and academic settings experience; 2) clinical researchers who study the outcome of neurovascular procedures and stroke and 3) directors of neurovascular training programs. All of them were selected by the AHA in order to have a wide representation of a broad range of experience, perspective, and expertise on neurovascular disease and treatment.

This guidelines is a very comprehensive and complete work. Due our interest subject in this review is intracranial vascular stenosis treatment, we will analyze from the recommendations fourth to the eleventh.

Aknowledgment about endovascular treatment of intracranial stenosis with stents is based in two studies: one for Neurolink intracranial stent system (Guidant, Santa Clara, Calif) and the other for Wingspan stent system (Boston Scientific). The first one with an incidence of more than 30% of reestenosis at sixth months, and the second with an incidence of 10% of restenosis at 6 months. Since the information brought by WASID study (1) (about the high risk of stroke in the territory of a significant stenosis of an intracranial vessel), there is evidence for indication of stent treatment to patients with no answer to other treatments.

Based on multiple studies of intraarterial thrombolysis with urokinase with good results but not enough for FDA approval of the product, the AHA/American Stroke Association guidelines for the early management of adults with ischemic stroke concluded that intra-arterial thrombolysis is an option for the treatment of selected patients who have major stroke of less than 6 hours of duration due to occlusion of the middle cerebral artery who are not otherwise candidates for intravenous rtPA.

For mechanical clot extraction there are two important studies; the first one performed with Mercy device and the other with a system denominated Penumbra (Penumbra, Inc, San Leandro, Calif) . Both devices are accepted for its use, but they have been experienced in separated studies without comparison between them nor with another system. There is no information about emergency treatment with stent for intracranial vessel stenosis. There is low evidence about the efficacy of these types of devices.

Discussion

Analysis of these papers gives credence to the following conclusions:

Atheromatous cerebral disease presents a high incidence, morbidity and mortality. Each new process constitutes advancements for a higher level of life quality and greater survive of the population. The first and second works analyzed in this article concentrate on the stent process in acute stroke. This subject is still in development phase, although it represents a future leap ahead in treatment possibilities.

In coronary illness treatment evolution revascularization procedures, by means of angioplasty and stenting, replaced intravenous fibrinolysis. The increase in stent application for the cerebral aneurysms offers an advances in learning curve for the handling of this element, with serious implications to the cerebral stenting for stroke. Greater advances in technological development are needed, since the reestenosis rate after stent placement is still high.

Otherwise, intraarterial rtpA fibrinolysis has a great utility in those patients which arrive late for intravenous treatment. (four hours and a half).

References

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