



UPDATE IN RADIOLOGY

Neuroimaging follow-up of cerebral aneurysms treated with endovascular techniques[☆]

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Abstract There are no specific recommendations in clinical guidelines about the best time, imaging tests, or intervals for following up patients with intracranial aneurysms treated with endovascular techniques. We reviewed the literature, using the following keywords to search in the main medical databases: cerebral aneurysm, coils, endovascular procedure, and follow-up. Within the Cerebrovascular Disease Group of the Spanish Society of Neuroradiology, we aimed to propose recommendations and an orientative protocol based on the scientific evidence for using neuroimaging to monitor intracranial aneurysms that have been treated with endovascular techniques. We aimed to specify the most appropriate neuroimaging techniques, the interval, the time of follow-up, and the best approach to defining the imaging findings, with the ultimate goal of improving clinical outcomes while optimizing and rationalizing the use of available resources.

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PALABRAS CLAVE

Aneurisma cerebral;
Espirales;

Seguimiento mediante técnicas de neuroimagen de los aneurismas cerebrales tratados por vía endovascular

Resumen No existen recomendaciones específicas en las guías de práctica clínica sobre el tiempo, prueba de imagen ni intervalo para controlar la evolución de los aneurismas

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◇ The members of SENR group are listed in [Annex 1](#).

Procedimiento endovascular y seguimiento

intracraneales tratados por vía endovascular. Hemos revisado la bibliografía existente en las principales bases de datos médicas usando como palabras clave: aneurisma cerebral, espirales, procedimiento endovascular y seguimiento. Nuestro objetivo ha sido, dentro del Grupo de Enfermedades Cerebrovasculares de la Sociedad Española de Neurorradiología, proponer unas recomendaciones y un protocolo orientativo, basados en la evidencia científica, para monitorizar mediante neuroimagen los aneurismas intracraneales tratados por técnicas endovasculares, incluyendo las técnicas de neuroimagen más adecuadas, el intervalo, el tiempo de seguimiento y la mejor forma de definir los hallazgos radiológicos, con el objetivo de mejorar los resultados clínicos y optimizar y racionalizar los recursos disponibles.

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Introduction

Subarachnoid hemorrhage (SAH) is considered to be one of the most serious acute cerebrovascular diseases and causes 5% of all hospital strokes. Its most important cause is the rupture of an intracranial aneurysm.

Prevalence of intracranial aneurysms in the overall population is 0.4% in retrospective studies of autopsies, 3.6% in retrospective angiographical studies and 6% in prospective studies.¹ The incidence of SAH ranges from 2 to 22.5 cases for every 100,000 person-year² with great variations among different regions. It is more common in women and it is associated with the consumption of tobacco, alcohol and cocaine, family syndromes and predisposing genetic diseases (Ehlers-Danlos, dominant autosomal heptorenal polycyst disease).³⁻⁵ Patients diagnosed with aneurysms have an annual risk of bleeding of 0.4% per year.⁶

The overall population mortality rate is 50% and hospital mortality rate depends directly on the clinical state at the moment of admission, the Fisher scale, the size of aneurysm and on the type of therapy used.⁷ The mortality rate of a ruptured untreated brain aneurysm is 60% being the dependency rate close to 15–20%. The main prognostic factor is the rate of re-bleeding around 20–30% during the first month and 3% afterwards.⁸

The surgical management of ruptured aneurysm started back in the 60s improved significantly the prognosis of these patients when reducing the rate of hospital mortality to 8–20% and the rate of dependent patients to 20–37%.⁹ Both the endovascular proceedings with platinum coils and assisted proceedings have improved the excellent results of surgical therapy leaving a mortality rate of 7–15% and the rate of dependent patients close to 20%.

In the year 2002 the *International Subarachnoid Aneurysm Trial Collaborative Group* (ISAT)¹⁰ multicenter randomized study was published; this study comprising 2143 patients in 43 centers compared surgical management to endovascular therapy. The manageable ruptured aneurysms through endovascular and surgical approaches were randomized leaving those aneurysms that were more accessible for each one of these arms of treatment under-represented. When it comes to disability-free survival at 1 year this study showed that the outcomes of endovascular therapy were way better than those of surgical management. The reduction of relative and absolute risks at 1 year in dependence or death of the endovascular group vs the surgical group was 22.6 and 6.9%, respectively. Still the rate of re-bleeding from surgical management is lower and the percentage of

closed aneurysms is significantly greater even though the ongoing analysis of the ISAT study through the years has shown that yet despite these inconveniences protection in terms of survival to endovascular therapy stays the same with the passing of time.^{11,12} Many prospective and retrospective studies have confirmed these findings.¹³⁻²³

Literature shows that intracranial aneurysms can reopen and grow after therapy.²⁴ This growth or recurrence of aneurysms is due to compaction of the coil mass, growth of the residual aneurysmal neck, or expansion of the back of the aneurysm.²⁵ There are also two (2) different types of aneurysms: (1) early—during the first six (6) months after therapy and (2) late—due to a regrowth of the aneurysm treated or to the appearance of a new aneurysm in the same location.²⁶

There are no specific recommendations in the guidelines of clinical practice on the time, image modality or interval used to do a follow-up of the aneurysms treated through endovascular approach.²⁷ The only consensus is that such a follow-up is a must and that it needs to be a long-term follow-up. In the guidelines of clinical practice published by the American Heart Association (AHA) in 2012 there is a class I-level-of-evidence B-recommendation for the follow-up of aneurysms treated through endovascular or surgical approach. This very general recommendation establishes that aneurysms treated need to be followed through an image modality and that both the time and the image modality need to be individualized.²⁸

The goal of this study is to establish recommendations and guideline protocols based on scientific evidence for the neuroimaging follow-up of intracranial aneurysms treated through endovascular therapy including more adequate neuro-image modalities, the interval, the time of follow-up and the most adequate way of defining radiological findings all in an attempt to improve clinical outcomes and rationalize the resources available. To that effect we looked for in the most important journals available in the last 10 years published in the most important medical databases (PubMed, EMB reviews, Cochrane Database of Systematic Reviews) using keywords like: brain aneurysm; coils; endovascular proceeding; and follow-up. We did a thorough review of clinical trials, meta-analyses and systematic reviews published for the last 10 years.^{10-26,29-62} Both the outcomes and the recommendations aimed at the assistance practice but not at research studies or the monitoring of clinical trials. These are the variables collected: author, journal, year of publication, number of patients treated, number of aneurysms treated, diagnostic proceedings used

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