EMBOLIZATION OF RUPTURED GIANT ANEURYSM OF THE MEDIUM CEREBRAL ARTERY FOLLOWED BY SURGICAL EVACUATION OF INTRACEREBRAL HEMATOMA

Embolización de aneurisma gigante roto de la arteria cerebral media seguido de evacuación quirúrgica de hematoma intracerebral

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ABSTRACT

Introduction: Early endovascular therapy of a ruptured giant aneurysm associated with intracerebral hematoma avoids the need for clipping of the aneurysm, thereby avoiding the need for greater brain retraction, edema, transient clipping, as well as the possibility of intraoperative rupture, thus achieving timely and adequate management of this pathology.

Clinical case: We present the case of a 48-year-old woman with subarachnoid hemorrhage (SAH) and intracerebral hematoma (ICH) due to dysplastic giant aneurysm of the right middle cerebral artery bifurcation (MCA) who was treated by coils embolization followed by microsurgical evacuation of the hematoma achieving a good result and a favorable clinical outcome.

Conclusion: The combined treatment by embolization with coils of a giant ruptured aneurysm of the MCA followed by the microsurgical evacuation of the ICH during the acute phase is an effective and safe alternative to single surgical management.

Keywords: Aneurysm Ruptured, Subarachnoid Hemorrhage, Hematoma, Embolization Therapeutic. (Source: MeSH NLM)

RESUMEN

Introducción: La terapia endovascular precoz de un aneurisma gigante roto asociado a hematoma intracerebral evita la necesidad del clipaje del aneurisma evitando con ello la necesidad de mayor retraición cerebral, edema, clipaje transitorio, así como la posibilidad de ruptura intraoperatoria, logrando de esta forma un manejo oportuno y adecuado de esta patología.

Caso clínico: Se presenta el caso de una mujer de 48 años con hemorragia subaracnoidea (HSA) y hematoma intracerebral (HIC) por aneurisma gigante displásico de la bifurcación de la arteria cerebral media (ACM) derecha que fue tratado por embolización con coils seguido de evacuación microquirúrgica del hematoma logrando un buen resultado y una evolución clínica favorable.

Conclusion: El tratamiento combinado mediante embolización con coils de un aneurisma gigante roto de la ACM seguido de la evacuación microquirúrgica del HIC durante la fase aguda es una alternativa eficaz y segura de manejo quirúrgico único.

Palabras Clave: Aneurisma roto, Hemorragia Subaracnoidea, Hematoma, Embolización Terapéutica (Fuente: DeCS Bireme)

Peru J Neurosurg 2020, 2 (2): 54-59

Subarachnoid hemorrhage (SAH) can present with intracerebral hematoma (ICH) in 4 to 42.6% with a mortality rate between 21-100%,1 ICH associated with SAH by aneurysm presents with poor degrees of Hunt Hess overshadowing the forecast.5,8,9 If the HSA generally has a 30-day mortality of 33 to 50%, the HIC due to aneurysm increases it to 80 to 100%.13

It is important to exclude the ruptured aneurysm as soon as possible to avoid rebleeding, however clipping in the acute phase represents a technical challenge due to the presence of hematoma and severe cerebral edema,2,5 which leads to the need for parenchymal retraction, and the risk of iatrogenic injury; In this context, endovascular therapy is a good management alternative in the acute phase of a ruptured aneurysm, as demonstrated in the ISAT (International Subarachnoid Aneurysm Trial).7

Submitted : March 20, 2020
Accepted : April 17, 2020

Studies on the technical and clinical efficacy of endovascular therapy prior to surgical evacuation of ICH have been reported, which despite having a small population show that the percentage of independent patients at one month of treatment exceeds 50%, with mortality relatively low compared to other surgical series and similarly to the results of series of patients in poor clinical condition without ICH.

**CLINICAL CASE**

**History and examination:** A 48-year-old female patient from Huancavelica, with a surgical history of cholecystectomy and cesarean section on 2 occasions, with a clinical picture of sudden-onset severe headache, transient consciousness disorder and left hemiparesis. A brain computed tomography (CT) was performed, which showed SAH Fisher IV with ICH (volume: 34cc) at the level of the right Silvio valley, so it was transferred to the Guillermo Almenara National Hospital 24 hours after the bleeding, due to the distance from the place of residence of the patient who lived in Huancavelica, 427 km from the city of Lima (06 hours approx. transfer by road).

On neurological examination: Glasgow Coma Scale (GCS) of 12, left hemiparesis 4/5, with stiff neck (Hunt Hess grade III). An angiography and cerebral panangiography were performed, showing a ruptured dysplastic saccular aneurysm in a bifurcation of the right MCA, of 25.7 mm x 19.5 mm and a neck width of 5.1 mm.

**Endovascular treatment:** Endovascular treatment was immediately performed using the Philips Allura 3D biplanar angiograph. Under general anesthesia, the PX SLIM™ microcatheter and Traxcess 14 microguide were navigated.
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Together with the HyperForm occlusion balloon to the aneurysm sac with Coils Penumbra 400TM deployment: 16 mm x 60 cm, 14 mm x 50 cm, 12 mm x 35 cm and 13 mm x 48 cm, reaching a total obliteration of the dome with a residual neck (Raymond Roy II), without complications.

**Clinical evolution:** At the end of the embolization procedure, the patient was transferred to the emergency surgery room for microsurgical treatment, performing a right frontotemporal craniotomy and a subtotal evacuation of the ICH by means of a transcortical approach performed by the same neurosurgical medical team, and was subsequently transferred to a neurocritical care unit.

In the following days, the patient had a good clinical evolution (15 points on the GCS), with improvement of the neurological deficit (modified Rankin scale II) and a hospital stay of 13 days. Control brain CT showed complete resolution of the hematoma without showing signs of infarction or cerebral bleeding.

**DISCUSSION**

The incidence of ICH associated with SAH is 42 to 84% of cases. The functional prognosis of these patients will be worse if at hospital admission they present a poor clinical state, ICH associated with signs of intracranial hypertension (ICH). Thus, only 30% become independent after 30 days, with a mortality rate of up to 50% with surgical treatment.

The most frequent location of HSA-associated ICH is at the frontal or temporal level in Silvio’s fissure due to the anatomical location of an anterior and middle cerebral artery aneurysm. Middle cerebral artery aneurysms (MCA) are susceptible to treatment with clipping, its evolution being favorable. Conversely, endovascular therapy of an aneurysm at this location is challenging since they are frequently dysplastic, have a wide neck or segmental branches incorporated into or very adjacent to their dome. There are studies that support this claim, such as the ISUIA (International Study of Unruptured Intracranial

![Fig 2.](image-url) (A) Digital subtraction angiography of the right internal carotid artery (ICA) with 3D reconstruction showing (B) dysplastic saccular aneurysm in bifurcation of the ruptured giant right MCA. (C) Embolization with balloon-assisted coils with angiographic control (D) showing subtotal obliteration, with adjacent patent vessels.
Aneurysms) with 704 MCA aneurysms treated, in which 92.3% were by clipping; 17 the BRAT (Barrow Ruptured Aneurysm Trial) where 67% of the MCA aneurysms initially assigned for embolization had to be clipped; 18 the guidelines of the American Heart Association / American Stroke Association 2012 that recommend clipping for MCA aneurysms with ICH greater than 50 cc. 19

According to Shimoda et al., precipitating factors for brain injury such as ICH, acute hydrocephalus, and seizures could be the cause of the neurological deficit on admission, being potentially reversible. 10 Heiskanen et al. described a mortality rate of 80% in patients who only underwent evacuation of the ICH compared to 27% in whom the aneurysm was also clipped; therefore, aneurysmal exclusion is recommended during the same procedure. However, in a surgical setting with large cerebral edema due to acute hemorrhage, ICH, and impaired self-regulation, where dissection and proximal arterial control can be challenging, the need for cortical retraction can cause parenchymal injury, significant cerebral edema, and ischemia, 2 as reported by Shimoda et al., who found 48% of post-clip bruises. 10

In recent years, endovascular technology is being integrated into microsurgical treatment for these vascular lesions. 4 Lawton et al. described that the management of complex aneurysms requires a combined strategy 11 integrating endovascular diagnosis and therapy with surgery.

That is why, the embolization of the aneurysm avoids the surgical need for a clip, thus avoiding the dissection,
retraction, transient clipping and eliminating the risk of intraoperative rupture of the aneurysm, a severe complication that can lead to death, achieving a procedure simpler, safer and faster surgical procedure. According to Houkin et al., 12.5% of intraoperative ruptures were caused by evacuation of the hematoma with acute decompression and 16.7% only by brain retraction.\textsuperscript{16}

Stapleton C. et al. described that of a total of 49 patients with MCA aneurysm and extensive intraparenchymal or Silvio Valley ICH who underwent clipping, 28.6% had intraoperative rupture.\textsuperscript{20} This is because the ICH surrounds the aneurysm, making arachnoid dissection difficult. around the neck of the aneurysm for the control of the main artery and clipping, causing rebleeding during the evacuation of the ICH.\textsuperscript{23} The difficulty of the surgical technique can prolong the time of surgery and increase the rate of complications (infection, pneumonia, pulmonary edema or heart failure), worsening prognosis.\textsuperscript{24}

Rebleeding is the most preventable cause of mortality and poor functional outcome, therefore, it is significant to establish a treatment strategy that leads to faster obliteration of the aneurysm without greater risks, since the rupture rate is three times higher in presence of ICH.\textsuperscript{15} In a series of 50 patients, the exclusion of the aneurysm within 6 hours of the clinical presentation was the most significant predictor of a favorable outcome (p <0.025), regardless of the treatment modality.\textsuperscript{15}

De los Reyes et al. demonstrated that patients embolized before ICH evacuation achieved aneurysm obliteration faster than those operated on by clipping (299 vs 885 min, p <0.001), which implies less time for general anesthesia, an additional benefit for elderly patients. advanced or with poor preoperative clinical conditions. Furthermore, no significant differences were found in terms of complications, hospital stay, functional outcome, and costs;\textsuperscript{14} Unless there is difficult vascular access due to unfavorable anatomy, surgery is preferred. It is worth mentioning that an embolized patient presented a complication due to the use of aspirin and heparin that was used to avoid the formation of thrombi due to the fact that a coil was projected towards the lumen of the main vessel, developing expansion of the HIC (23 cc to 50 cc) ; For this reason, a total packaging in terms of complications is demonstrated, emphasizing the creation of hybrid operating rooms where the two pathologies can be treated in a single moment.

With the presentation of this case, the viability and safety of endovascular therapy before immediate microsurgical evacuation is demonstrated, emphasizing the creation of hybrid operating rooms since there is a clear benefit of combined management in complex aneurysms.

**CONCLUSION**

The efficacy of combined emergency treatment is demonstrated by embolization with coils of a giant ruptured aneurysm of the MCA, followed by microsurgical evacuation of the associated HIC during the acute phase. This case demonstrates that this treatment is a feasible and safe alternative to joint endovascular and microsurgical management.

**REFERENCES**

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Disclosures
The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Authors Contributions
Conception and design: All authors. Drafting the article: Urquizo. Critically revising the article: Rodriguez. Reviewed submitted version of manuscript: Urquizo. Approved the final version of the manuscript on behalf of all authors: Urquizo.

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