International Journal of Healthcare Sciences ISSN 2348-5728 (Online)
Vol. 4, Issue 2, pp: (21-26), Month: October 2016 - March 2017, Available at: www.researchpublish.com

Surgical Approaches to Manage Cerebral Aneurysms, Systematic Review

[1]Abdulrazaq Hudhayri A. Alhazeemi, [2]Fahad Khalid F. Alshubaily,
[3]Abdulaziz Hamdan A. Alazmi, [4]Abdullah Suleman S. Almazied,
[5]Sultana Ali S. Alshammari, [6]Amirah Ali S. Alshammari,
[7]Dalia Abdullah M. Aljohani

Abstract: **Cerebral aneurysms are common among the general population, occurring in 2%–3%, but there are several factors that may increase one's risk. Cerebral aneurysms are seen more commonly in woman than men, particularly in those over 50 years of age, a group in which women are twice as likely to have cerebral aneurysms. This study was aimed to use systematic review to evaluate and demonstrate the different surgical approaches in management of cerebral aneurysms based on evidence studies that compared the clinical outcomes in patients with different surgical procedures and outcome treatment. We searched the published literature using Medline (Pubmed) and CENTRAL databases with following keywords combinations: cerebral aneurysm , endovascular coiling or microsurgical clipping, stent-assisted coiling ,balloon-assisted coiling , aneurysm; coiling, aneurysm, stent and balloon. Additionally, we hand-searched references in relevant primary publications to identify other eligible trials and studies. The described searches included original literature published up to August 2016. We concluded that both techniques were associated with similar and low complication rates. It was previously reported that the rates of complications with both surgical clipping and. Endovascular coiling is higher in ruptured aneurysms versus unruptured aneurysms. In cases of ruptured aneurysms, preference is often given to Endovascular coiling procedure to avoid potential complications caused by antiplatelet regiment accompanying surgical clipping.**

Keywords: **Cerebral aneurysms, surgical approaches.**

1. INTRODUCTION

Cerebral aneurysms are the leading reason for non-traumatic subarachnoid hemorrhage (SAH) and represent 70-80% of SAH cases (1). Cerebral aneurysms are common among the general population, occurring in 2%–3%, but there are several factors that may increase one's risk. Cerebral aneurysms are seen more commonly in woman than men, particularly in those over 50 years of age, a group in which women are twice as likely to have cerebral aneurysms (2). There appears to also be an increase in prevalence in older age groups (2). Unattended burst cerebral aneurysms are related to a high death and a danger of rebleeding (3). A big part of cerebrovascular neurosurgery is guided towards medical diagnosis and treatment of aneurysms prior to their rupture. The rupture danger of cerebral aneurysms is straight associated to the size, shape, and place of the aneurysm based upon big center research studies (4,5).

Treatment of intracranial aneurysms has actually developed considerably in the previous 100 years with enhancements in medical diagnosis and surgical strategies (6). Microsurgical clipping and endovascular coil embolization are the two primary treatment techniques for obliteration of burst and unruptured aneurysms.

Aneurysms typically have actually been treated with a craniotomy and microsurgical clipping throughout the neck of the aneurysm (7). Craniotomy and clipping of aneurysms is a moderate danger surgical treatment that is endured relatively well, depending upon the pre-treatment medical grade of the patient (7).

Specific medical conditions can increase the danger of aneurysms, consisting of intracranial arteriovenous malformation, (8) coarctation of the aorta, (9) and fibromuscular dysplasia (10). Autosomal dominant polycystic kidney illness likewise brings an increased danger of intracranial aneurysms (UIA), with a current research study revealing a frequency of 12.4% (21.6% in those with household history of aneurysm or hemorrhagic stroke) (11). Specific flexible attributes might put an individual at increased danger for aneurysmal SAH consisting of smoking cigarettes, alcohol usage, and high blood pressure (12). Intracranial aneurysms are most commonly seen at the bifurcation of arteries in the proximal circle of Willis (**Figure 1**) (12).

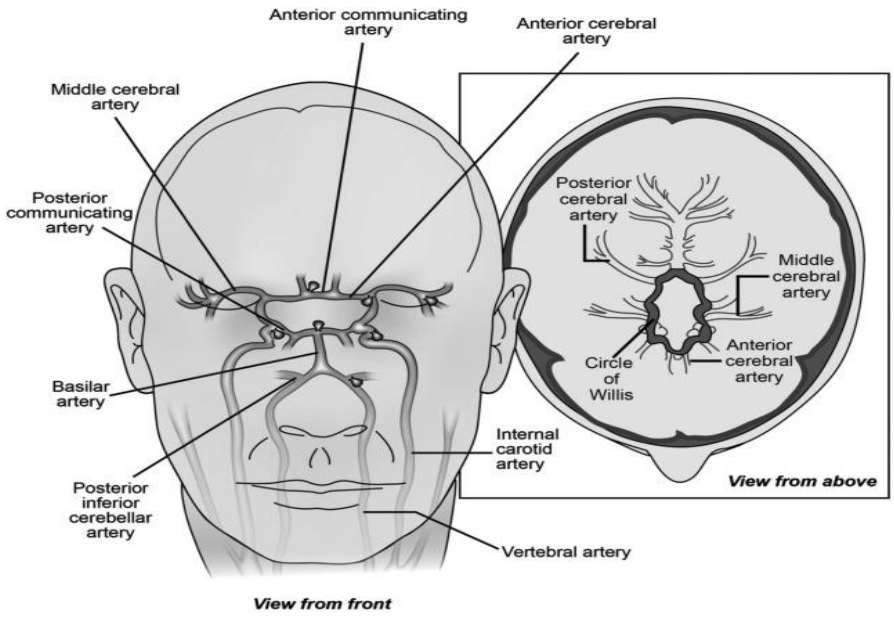

Figure1: circle of Willis

OBJECTIVES:

The objective of our study was to use systematic review to evaluate and demonstrate the different surgical approaches in management of cerebral aneurysms based on evidence studies that compared the clinical outcomes in patients with different surgical procedures and outcome treatment.

2. METHODOLOGY

A Systematic review study was conducted Search Strategy:

We followed the PRISMA guidance for systematic reviews of observational and diagnostic studies (13). We searched the published literature using Medline (Pubmed) and CENTRAL databases with following keywords combinations: cerebral aneurysm , endovascular coiling or microsurgical clipping, stent-assisted coiling ,balloon-assisted coiling , aneurysm; coiling, aneurysm, stent and balloon. Additionally, we hand-searched references in relevant primary publications to identify other eligible trials and studies. The described searches included original literature published up to August 2016. We included papers that evaluate or compared different surgical treatment methods in patients with ruptured or unruptured cerebral aneurysms in term of prospective studies, retrospective studies, systematic reviews and meta-analysis. We excluded letters, comments, editorials, case reports, proceeding, personal communication, expert opinions, as well as studies with insufficient data or no reported comparison between patients groups. Data extraction Data was extracted independently by different reviewers.

3. RESLTS AND DISCUSSION

The management of unruptured cerebral aneurysms remains one of the most controversial topics in neurosurgery. The International Study of Unruptured Intracranial Aneurysms (ISUIA) investigators have actually released potential assessments concerning the morbidity and death (M&M) for the treatment of patients with unruptured intracranial aneurysms (UIAs) (14,15). The International Study of Unruptured Intracranial Aneurysms (ISUIA) cannot come to a guaranteed conclusion regarding whether UIAs ought to be dealt with or not and, if so, which technique ought to be utilized. (14,15) According to the ISUIA, (15) no treatment is suggested for asymptomatic little aneurysms found in the anterior flow. This suggestion is based upon previous surgical results compared to the nature of such aneurysms. The information from the ISUIA show no considerable distinction in unfavorable results in between clipping and coiling, although endovascular coiling yields a greater rate of recanalization. Despite the fact that lots of research studies have actually reported beneficial results following treatment of UIAs, there appears to be predisposition based upon the dealing with doctor: Surgery is chosen by neurosurgeons, and endovascular treatment is typically promoted by neuro-interventionists (16,17,18,19,20,21,22,23,24).

The morbidity and death of surgical treatment for unruptured cerebral aneurysms was among the primary results examined in the ISUIA research studies (14,15). The preliminary friend studied included 1172 patients, which 211 had a previous history of SAH from another sore (14). Lots of Komotar et al. 22 of these unruptured aneurysms were symptomatic, with 34% having headaches, 14% with cranial nerve deficits, 11% with cerebrovascular ischemic occasions, 6% with lesion-induced mass result, and 5% with epilepsy. The authors discovered age reliant results, as the morbidity and death at 1 year follow-up for patients below 45 to be 6.5%; for those 45-64, 14.4%, and for those older than 64, 32% (p10mm) situated more frequently in the anterior blood circulation (83.4 vs. 73.6%). It is uncertain whether these friend distinctions suffice to represent this inconsistency in postsurgical results, especially considering that the existence of medical co-morbidities, a recognized danger element, was not tape-recorded in ISUIA. The follow-up ISUIA research study in 2003 examined 1591 patients at 7days, discharge, 30 days, and annual (15). Findings consisted of 1.8% and 12.0% death and morbidity at 30 days, and 2.7% and 10.1% death and morbidity at 1 year. In this mate, asymptomatic patients below 50 years of age with unruptured aneurysms less than 24mm in size situated in the anterior blood circulation had the most affordable rates of surgical threat, priced estimate at 5-6% at 1 year.

Surgical clipping technique:

Surgical clipping of aneurysms was presented in 1937 by Dr. Walter Dandy, who utilized it to effectively deal with a client with an agonizing 3rd nerve palsy triggered by an internal carotid aneurysm (25). Today, the aneurysm is usually accessed through an open craniotomy, where the aneurysm is dissected out and a small metal clip, which is chosen based upon the UIA anatomy, is put at the aneurysm and the neck separated from the moms and dad capillary (**figure 2**)

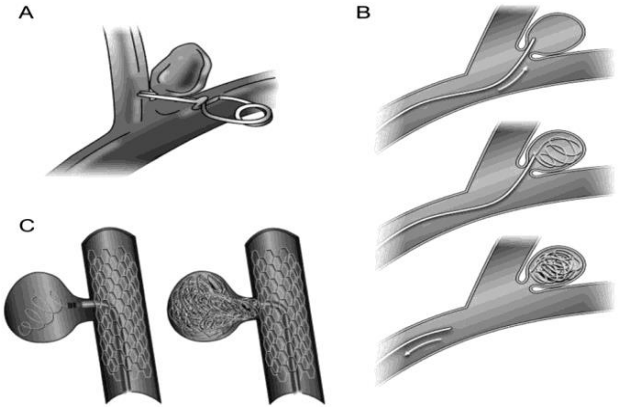

Figure2: Aneurysm interventions, (A) Aneurysm clipping. (B) Endovascular coiling. (C) Endovascular coiling with stent assistance

Two large meta-analyses (26,27) assessed UIA surgical clipping results. One revealed a morbidity rate of 4.1% and death rate of 1% and consisted of a greater portion of smaller sized and anterior flow aneurysms (26). The other revealed a morbidity rate of 10.9% with death rate of 2.6%, however consisted of a fairly high variety of posterior blood circulation aneurysms (29.7%) and huge aneurysms (27.1%) (27). These meta-analyses represent the cumulating of released numbers on morbidity and death, which might not be representative of the real morbidity and death happening from these surgical treatments in the majority of scientific settings. Surgical clipping appears to usually work with total occlusion acquired in higher than 90% of cases (28).

Clipping after coiling of aneurysm :

Civit et al. shared their early experience clipping ruptured aneurysms that were formerly coiled in the severe phase. An excellent result was reported in this series that consisted of partly coiled aneurysms, aneurysm reoccurrence, and/or re-rupture after coiling (32). If coils extend to the aneurysm neck they can hold the aneurysm walls apart and change the soft neck into a wedge that can splay clip blades, triggering a clip to move down the neck and occlude moms and dad and branch vessels.

Microsurgical clipping might be utilized as a more conclusive treatment after preliminary coil embolization. This combined treatment is extremely beneficial in ruptured aneurysms where coiling supplies short-term defense of the aneurysm dome up until the client recuperates. When much better endured, microsurgical clipping can then be finished in an interval style. Microsurgery in the setting of a ruptured aneurysm can be challenging due to hydrocephalus, brain edema, and modified cerebral hemodynamics. If considerable recurring is present (29,30), subsequent clipping. This

circumstance might not apply to all aneurysms, specifically blister and little aneurysms, which have a high threat of rupture with endovascular coiling (31).

Civit et al. shared their early experience clipping ruptured aneurysms that were formerly coiled in the severe phase. An excellent result was reported in this series that consisted of partly coiled aneurysms, aneurysm reoccurrence, and/or re-rupture after coiling (32). In patients providing with extreme vasospasm, partial coiling followed by staged conclusive clipping is a great algorithm to prevent microsurgical adjustment of vessels in the setting of vasospasm (33). Rabenstein et al. reported a high occurrence of vasospasm in SAH patients treated with clipping versus coiling (34). The vasospasm treatment and coiling can be finished throughout the exact same treatment securely.

Waldron et al. reported their experience clipping formerly coiled aneurysms. Partly coiled aneurysms are tough and uncollapsible to control. If coils encompass the aneurysm neck they can hold the aneurysm walls apart and change the soft neck into a wedge that can splay clip blades, triggering a clip to move down the neck and occlude moms and dad and branch vessels. Coils can avoid total closure of the neck and can extrude into the subarachnoid area to make complex the dissection of the aneurysm or branch arteries. Thrombus development can solidify an aneurysm and often coils might need to be gotten rid of prior to safe clipping can be carried out. Sometimes a bypass might be had to securely eliminate coils and thrombus with clip restoration of the aneurysm (29). It is, nevertheless, suggested not to get rid of coils when possible.

Endovascular coiling:

Endovascular management emerged as a treatment modality in the 1990s and has been increasing in popularity since that time (35,36). This procedure is now more common than surgery for management of UIA in the United States (35). In the most common form of endovascular management, platinum coils are introduced into the aneurysm, causing local thrombosis and isolation of the aneurysm from the parent artery. Certain cases may not be candidates for this form of intervention including large aneurysms, aneurysms with a wide neck, high dome-to-neck ratio, or those with difficult intravascular approaches(36). Adjunct techniques such as balloon inflation or stent placement at the aneurysm neck are increasingly used in some of these more difficult cases (**figure 2**) (37). Other endovascular techniques include use of flow diverting stents and use of liquid embolic agents, which are typically used for large aneurysms(37).

For endovascular management, the risk of unfavorable outcomes is approximately 4%–5%, with a risk of mortality of 1%–2% based on review and meta-analysis of existing literature(37,38). The rate of poor outcomes with endovascular procedures appears to be decreasing over time, but the characteristics of aneurysms treated by endovascular procedures are also changing over time, making it difficult to determine if this change is due to improvement of technique or a change in patient population (37). Aneurysms are successfully occluded 86.1% of the time based on postprocedure imaging, with recurrence in 24.4% and need for retreatment in 9.1% (38). The ISUIA study group also assessed outcomes prospectively for endovascular coiling in 451 patients. The 1-year morbidity rate was 6.4% and the mortality rate was 3.1% (15). Of note, as the baseline characteristics of this group were different from the surgery group (including older patients, larger aneurysms, and larger number of posterior circulation aneurysms), the results are not directly comparable. The risk of poor outcome with endovascular procedure was higher with aneurysm diameter greater than 12 mm and posterior circulation location.

As there are no randomized trials to directly compare management options for UIAs, one can consider clinical trials regarding the management of ruptured aneurysms for further information. The International Subarachnoid Aneurysm Trial directly compared surgical clipping to endovascular coiling for ruptured intracranial aneurysms in a prospective randomized trial (39). In this study, the risk of death or dependency was lower in the endovascular treatment group (23.5%) compared to the neurosurgical group (30.9%), with a risk reduction of 7.4% that was statistically significant (39).

4. CONCLUSION

Both techniques were associated with similar and low complication rates. It was previously reported that the rates of complications with both surgical clipping and. Endovascular coiling is higher in ruptured aneurysms versus unruptured aneurysms. In cases of ruptured aneurysms, preference is often given to Endovascular coiling procedure to avoid potential complications caused by antiplatelet regiment accompanying surgical clipping. Furthermore, a balloon may provide control of bleeding and prevent severe complications. We did not differentiate between ruptured and unruptured aneurysms in the present study. Comparative analysis of surgical clipping and Endovascular coiling in ruptured versus unruptured aneurysms may be clinically relevant topic for the future studies.

REFERENCES

[1] Zacharia BE, Hickman ZL, Grobelny BT, DeRosa P, Kotchetkov I, Ducruet AF, et al. Epidemiology of aneurysmal subarachnoid hemorrhage. Neurosurg Clin N Am (2010) 21(2):221–3310.1016/j.nec.2009.10.002.

[2] Vlak MH, Algra A, Brandenburg R, Rinkel GJ. Prevalence of unruptured intracranial aneurysms, with emphasis on sex, age, comorbidity, country, and time period: a systematic review and meta-analysis. Lancet Neurol 2011;10:626–636

[3] Rabinstein AA. Subarachnoid hemorrhage. Neurology (2013) 80(5):e56–910.1212/WNL.0b013e3182834b22.

[4] Investigators UJ, Morita A, Kirino T, Hashi K, Aoki N, Fukuhara S, et al. The natural course of unruptured cerebral aneurysms in a Japanese cohort. N Engl J Med (2012) 366(26):2474–8210.1056/NEJMoa1113260.

[5] Wiebers DO, Whisnant JP, Huston J, III, Meissner I, Brown RD, Jr, Piepgras DG, et al. Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. Lancet (2003) 362(9378):103–1010.1016/S0140-6736(03)13860-3.

[6] Washington CW, Vellimana AK, Zipfel GJ, Dacey RG. The current surgical management of intracranial aneurysms. J Neurosurg Sci (2011) 55(3):211–31.

[7] Colby GP, Coon AL, Tamargo RJ. Surgical management of aneurysmal subarachnoid hemorrhage. Neurosurg Clin N Am (2010) 21(2):247–6110.1016/j.nec.2009.10.003.

[8] Brown RD, Jr, Wiebers DO, Forbes GS. Unruptured intracranial aneurysms and arteriovenous malformations: frequency of intracranial hemorrhage and relationship of lesions. J Neurosurg 1990;73:859–863.

[9] Connolly HM, Huston J, 3rd, Brown RD, Jr, Warnes CA, Ammash NM, Tajik AJ. Intracranial aneurysms in patients with coarctation of the aorta: a prospective magnetic resonance angiographic study of 100 patients.Mayo Clin Proc 2003;78:1491–1499.

[10] Olin JW, Sealove BA. Diagnosis, management, and future developments of fibromuscular dysplasia. J Vasc Surg 2011;53:826–836.

[11] Xu HW, Yu SQ, Mei CL, Li MH. Screening for intracranial aneurysm in 355 patients with autosomal-dominant polycystic kidney disease. Stroke 2011;42:204–206

[12] van Gijn J, Kerr RS, Rinkel GJ. Subarachnoid haemorrhage. Lancet 2007;369:306–318.

[13] A. Liberati, D.G. Altman, J. Tetzlaff, C. Mulrow, P.C. Gotzsche, J.P. Ioannidis, et al., The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration, J. Clin. Epidemiol. 62 (2009) e1–34.

[14] International Study of Unruptured Intracranial Aneurysms Investigators. Unruptured intracranial aneurysm - risk of rupture and risks of surgical intervention. N Engl J Med. 1998 Dec;339(24):1725–1733.

[15] Wiebers DO, Whisnant JP, Huston J, 3rd, Meissner I, Brown RD, Jr, Piepgras DG, et al. Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment.Lancet. 2003 Jul;362(9378):103–110.

[16] Brinjikji W, Lanzino G, Cloft HJ, Rabinstein A, Kallmes DF. Endovascular treatment of middle cerebral artery aneurysms: a systematic review and single-center series. Neurosurgery. 2011 Feb;68(2):397–402.discussion 402.

[17] Guglielmi G, Vinuela F, Duckwiler G, Jahan R, Cotroneo E, Gigli R. Endovascular treatment of middle cerebral artery aneurysms. Overall perioperative results. Apropos of 113 cases. Interv Neuroradiol. 2008 Sep;14(3):241–245.

[18] Iijima A, Piotin M, Mounayer C, Spelle L, Weill A, Moret J. Endovascular treatment with coils of 149 middle cerebral artery berry aneurysms. Radiology. 2005 Nov;237(2):611–619.

[19] King JT, Jr, Berlin JA, Flamm ES. Morbidity and mortality from elective surgery for asymptomatic, unruptured, intracranial aneurysms: a meta-analysis. J Neurosurg. 1994 Dec;81(6):837–842.

[20] Morgan MK, Mahattanakul W, Davidson A, Reid J. Outcome for middle cerebral artery aneurysm surgery. Neurosurgery. 2010 Sep;67(3):755–761. discussion 761.

[21] Moroi J, Hadeishi H, Suzuki A, Yasui N. Morbidity and mortality from surgical treatment of unruptured cerebral aneurysms at Research Institute for Brain and Blood Vessels-Akita. Neurosurgery. 2005 Feb;56(2):224–231.

[22] Quadros RS, Gallas S, Noudel R, Rousseaux P, Pierot L. Endovascular treatment of middle cerebral artery aneurysms as first option: a single center experience of 92 aneurysms. AJNR Am J Neuroradiol. 2007 Sep;28(8):1567–1572.

[23] Raaymakers TW, Rinkel GJ, Limburg M, Algra A. Mortality and morbidity of surgery for unruptured intracranial aneurysms: a meta-analysis. Stroke. 1998 Aug;29(8):1531–1538.

[24] Regli L, Uske A, de Tribolet N. Endovascular coil placement compared with surgical clipping for the treatment of unruptured middle cerebral artery aneurysms: a consecutive series. J Neurosurg. 1999 Jan;90(6):1025–1030.

[25] Louw DF, Asfora WT, Sutherland GR. A brief history of aneurysm clips. Neurosurg Focus 2001;11:E4.

[26] King JT, Jr, Berlin JA, Flamm ES. Morbidity and mortality from elective surgery for asymptomatic, unruptured, intracranial aneurysms: a meta-analysis. J Neurosurg 1994;81:837–842

[27] Raaymakers TW, Rinkel GJ, Limburg M, Algra A. Mortality and morbidity of surgery for unruptured intracranial aneurysms: a meta-analysis. Stroke 1998;29:1531–1538

[28] David CA, Vishteh AG, Spetzler RF, Lemole M, Lawton MT, Partovi S. Late angiographic follow-up review of surgically treated aneurysms. J Neurosurg 1999;91:396–401

[29] Waldron JS, Halbach VV, Lawton MT. Microsurgical management of incompletely coiled and recurrent aneurysms: trends, techniques, and observations on coil extrusion. Neurosurgery (2009) 64(5 Suppl 2):301–15 discussion 15-7,10.1227/01.NEU.0000335178.15274.B4.

[30] Nakamura M, Montibeller GR, Gotz F, Krauss JK. Microsurgical clipping of previously coiled intracranial aneurysms. Clin Neurol Neurosurg (2013) 115(8):1343–910.1016/j.clineuro.2012.12.030.

[31] Doorenbosch X, Harding M. Primary treatment of a blood-blister-like aneurysm of the internal carotid artery with Guglielmi detachable coil embolisation. J Clin Neurosci (2008) 15(11):1276–910.1016/j.jocn.2007.08.023

[32] Civit T, Auque J, Marchal JC, Bracard S, Picard L, Hepner H. Aneurysm clipping after endovascular treatment with coils: a report of eight patients. Neurosurgery (1996) 38(5):955–60 discussion 60-1,10.1097/00006123-199605000-00021

[33] Brisman JL, Roonprapunt C, Song JK, Niimi Y, Setton A, Berenstein A, et al. Intentional partial coil occlusion followed by delayed clip application to wide-necked middle cerebral artery aneurysms in patients presenting with severe vasospasm. Report of two cases. J Neurosurg (2004) 101(1):154–810.3171/jns.2004.101.1.0154.

[34] Rabinstein AA, Pichelmann MA, Friedman JA, Piepgras DG, Nichols DA, McIver JI, et al.Symptomatic vasospasm and outcomes following aneurysmal subarachnoid hemorrhage: a comparison between surgical repair and endovascular coil occlusion. J Neurosurg (2003) 98(2):319–2510.3171/jns.2003.98.2.0319.

[35] Brinjikji W, Rabinstein AA, Nasr DM, Lanzino G, Kallmes DF, Cloft HJ. Better outcomes with treatment by coiling relative to clipping of unruptured intracranial aneurysms in the United States, 2001–2008. AJNR Am J Neuroradiol 2011;32:1071–1075.

[36] Dovey Z, Misra M, Thornton J, Charbel FT, Debrun GM, Ausman JI. Guglielmi detachable coiling for intracranial aneurysms: the story so far. Arch Neurol 2001;58:559–564.

[37] Naggara ON, Lecler A, Oppenheim C, Meder JF, Raymond J. Endovascular treatment of intracranial unruptured aneurysms: a systematic review of the literature on safety with emphasis on subgroup analyses. Radiology 2012;263:828–835.

[38] Naggara ON, White PM, Guilbert F, Roy D, Weill A, Raymond J. Endovascular treatment of intracranial unruptured aneurysms: systematic review and meta-analysis of the literature on safety and efficacy.Radiology 2010;256:887–897.

[39] Molyneux AJ, Kerr RS, Yu LM, et al. International subarachnoid aneurysm trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised comparison of effects on survival, dependency, seizures, rebleeding, subgroups, and aneurysm occlusion.Lancet 2005;366:809–817