Surgical clipping versus endovascular coiling for intracranial aneurysm

- Comparative meta-analysis of microsurgery versus endovascular therapy and bypass versus nonbypass techniques for blister-like aneurysms: enigmas of the supraclinoid internal carotid artery
- Preventive clipping versus coiling in unruptured intracranial aneurysms: A comprehensive meta-analysis and systematic review to explore safety and efficacy
- A randomized trial comparing endovascular and surgical management of ruptured intracranial aneurysms excluded from previous trials
- Treatment of patients with aneurysmal subarachnoid hemorrhage and multiple aneurysms: Concurrent versus delayed treatment
- Role of clipping in aneurysmal subarachnoid hemorrhage: a post hoc analysis of the Earlydrain trial
- Clinical and Anatomical Characteristics of Perforator Aneurysms of the Posterior Cerebral Artery: A Single-Center Experience
- Comparative Effectiveness of Therapies in 2665 Elderly Patients with Ruptured Intracranial Aneurysms
- REACT: a randomized trial to assess the efficacy and safety of clazosentan for preventing clinical deterioration due to delayed cerebral ischemia after aneurysmal subarachnoid hemorrhage

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The two most commonly used methods to occlude the aneurysm for prevention of rebleeding are microsurgical clipping of the neck of the aneurysm and occlusion of the lumen of the aneurysm by means of endovascular coiling.

Lindgren et al. from the Department of Neurosurgery, Kuopio University Hospital, Finland, performed in 2018 an update of a systematic review that was previously published in 2005.

They searched the Cochrane Stroke Group Trials Register (March 2018). In addition, they searched CENTRAL (2018, Issue 2), MEDLINE (1966 to March 2018), Embase (1980 to March 2018), US National Institutes of Health Ongoing Trials Register (March 2018), and World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) (last searched March 2018). They also contacted trialists.

They included randomised trials comparing endovascular coiling with neurosurgical clipping in people with SAH from a ruptured aneurysm.

Two review authors independently extracted data, and assessed trial quality and risk of bias using the GRADE approach. They contacted trialists to obtain missing information. They defined poor outcome as death or dependence in daily activities (modified Rankin scale 3 to 6 or Glasgow Outcome Scale (GOS) 1 to 3). In the special worst-case scenario analysis, we assumed all participants in the group with better outcome with missing follow-up information had a poor outcome and those in the other group with missing data a good outcome.

They included four randomised trials involving 2458 participants (range per trial: 20 to 2143

participants). Evidence is mostly based on the largest trial. Most participants were in good clinical condition and had an aneurysm on the anterior circulation. None of the included trials was at low risk of bias in all domains. One trial was at unclear risk in one domain, two trials at unclear risk in three domains, and one trial at high risk in one domain.After one year of follow-up, 24% of participants randomised to endovascular treatment and 32% of participants randomised to the surgical treatment group had poor functional outcome. The risk ratio (RR) of poor outcome (death or dependency) for endovascular coiling versus neurosurgical clipping was 0.77 (95% confidence interval (CI) 0.67 to 0.87; 4 trials, 2429 participants, moderate-quality evidence), and the absolute risk reduction was 7% (95% CI 4% to 11%). In the worst-case scenario analysis for poor outcome, the RR for endovascular coiling versus neurosurgical clipping was 0.80 (95% CI 0.71 to 0.91), and the absolute risk reduction was 6% (95% CI 2% to 10%). The RR of death at 12 months was 0.80 (95% CI 0.63 to 1.02; 4 trials, 2429 participants, moderate-quality evidence). In a subgroup analysis of participants with an anterior circulation aneurysm, the RR of poor outcome was 0.78 (95% CI 0.68 to 0.90; 2 trials, 2157 participants, moderate-quality evidence), and the absolute risk decrease was 7% (95% CI 3% to 10%). In subgroup analysis of those with a posterior circulation aneurysm, the RR was 0.41 (95% CI 0.19 to 0.92; 2 trials, 69 participants, low-quality evidence), and the absolute decrease in risk was 27% (95% CI 6% to 48%). At five years, 28% of participants randomised to endovascular treatment and 32% of participants randomised to surgical treatment had poor functional outcome. The RR of poor outcome for endovascular coiling versus neurosurgical clipping was 0.87 (95% CI 0.75 to 1.01, 1 trial, 1724 participants, low-quality evidence). At 10 years, 35% participants allocated to endovascular and 43% participants allocated to surgical treatment had poor functional outcome. At 10 years RR of poor outcome for endovascular coiling versus neurosurgical clipping was 0.81 (95% CI 0.70 to 0.92; 1 trial, 1316 participants, low-quality evidence). The RR of delayed cerebral ischaemia at two to three months for endovascular coiling versus neurosurgical clipping was 0.84 (95% CI 0.74 to 0.96; 4 trials, 2450 participants, moderate-quality evidence). The RR of rebleeding for endovascular coiling versus neurosurgical clipping was 1.83 (95% CI 1.04 to 3.23; 4 trials, 2458 participants, high-quality evidence) at one year, and 2.69 (95% CI 1.50 to 4.81; 1 trial, 1323 participants, low-quality evidence) at 10 years. The RR of complications from intervention for endovascular coiling versus neurosurgical clipping was 1.05 (95% CI 0.44 to 2.53; 2 trials, 129 participants, low-quality evidence).

AUTHORS' CONCLUSIONS: The evidence in this systematic review comes mainly from one large trial, and long-term follow-up is available only for a subgroup of participants within that trial. For people in good clinical condition with ruptured aneurysms of either the anterior or posterior circulation the data from randomised trials show that, if the aneurysm is considered suitable for both neurosurgical clipping and endovascular coiling, coiling is associated with a better outcome. There is no reliable trial evidence that can be used directly to guide treatment in people with a poor clinical condition [1].

Of 4 published randomized trials comparing coiling and clipping—a Li et al. study, the Finnish study, ISAT, and BRAT—only ISAT was sufficiently powered to detect relatively small differences between the treatment modalities [2] [3] [4] [5].

The dilemma concerning the appropriate treatment of the intracranial aneurysms (IAs) has not yet been resolved and still remains under fierce debate.

The comparative effectiveness of the two treatment options (surgical clipping and endovascular coiling) for ruptured intracranial aneurysms in a cohort of Medicare patients, was not able to demonstrate a difference in mortality, rate of discharge to rehabilitation, and readmissions between clipping and coiling of ruptured cerebral aneurysms. Clipping was associated with a slightly longer

length of stay (LOS) [6].

A major difference between clipping and coiling is the closure of the aperture by the surgical clip which approximates the vessel walls.

During coil embolization, that aperture stays open, allowing in some cases further compaction of the coils in subsequent months and years.

Recanalization attributable to compaction depends on the size of the aneurysm and may necessitate repacking in up to 40% of the cases (aneurysms > 25 mm). As for the risk of rebleeding, a recanalized aneurysm is comparable to a partially clipped aneurysm. As the surgical results from early and delayed operations were obtained in randomized controlled studies, such randomized comparative studies will need to be applied to assess the value and risks and long-term results of endovascular strategies [7].

A analysis of treatment of IAs performed in Poland between 2009-2012. Patients' records were cross-matched by ICD-9 codes for ruptured SAH (430) or unruptured cerebral aneurysm (437.3) along with codes for clipping (39.51) and coiling (39.79, 39.72, or 39.52). Multivariable logistic regression was used to compare in-hospital deaths, hospital length of stay (LOS), therapy allocation and aneurysm locations in unruptured vs. ruptured and clipped vs. coiled groups. Differences in the number of procedures between 16 administrative regions were standardized per 100,000 people.

11,051 procedures were identified, including 5,968 ruptured and 5,083 unruptured aneurysms. Overall increase was 2.3 % in clipping and 13.1 % in coiling; a significant trend was found in endovascular procedures ($p = 0.044$). Ruptured aneurysms were clipped more frequently (OR = 1.66;); in unruptured IAs, endovascular procedure was preferred 3.5 times more than clipping. The annual in-hospital mortality was 7.6 % in clipping and 6.7 % in endovascular treatment. LOS was two times longer after clipping in unruptured aneurysms (OR = 2.013). After the procedures were standardized per 100,000 people, the average for Poland was established as 9.09 in 2009, 10.86 in 2010, 10.55 in 2011, and 11.49 in 2012. This index had the highest values in Mazovia (12.9, 2009; 15.4, 2010; 17.4, 2011; 18.6, 2012.

Data analysis revealed an increase in overall number of IAs treated in Poland between 2009-2012. A significant upward trend of endovascular procedures was found, whereas the number of clipped aneurysms remained relatively steady over the study period [8].

Coiling

Is efficacious and safe, but durability needs improvement, as nearly 20% of patients require further invasive intervention secondary to aneurysm recurrence [9].

1)
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