Aneurysm remnant

see also Aneurysm recurrence.

Residual aneurysm neck

The complete clipping of a intracranial aneurysm usually warrants its sustained occlusion, while clip remnants may have far-reaching consequences.

Epidemiology

Aneurysm remnants were identified in 36 (5.7%) of 637 aneurysms that were surgically treated. Atherosclerosis ($P < 0.01$) or multiple clip applications ($P < 0.01$) were significantly associated with aneurysm remnants [1].

Raymond-Roy Occlusion Classification

Raymond-Roy Occlusion Classification.

Sindou residual grading system

Sindou residual grading system

Growing evidence suggests that three-dimensional digital subtraction angiography (3D-DSA) is superior to 2D-DSA in detection of intracranial aneurysm remnants after clipping. With a simple, practical quantitative scale proposed to measure maximal remnant dimension on 3D-DSA, this study provides a rigorous interrater and intrarater reliability and agreement study comparing this newly established scale with a commonly used Sindou residual grading system 2D-DSA scale.

Records of 43 patients with clipped IAs harboring various sized remnants who underwent 2D- and 3D-DSA between 2012 and 2018 were evaluated. Using the 2D and 3D scales, six raters scored these remnants and repeated the scoring task 8 weeks later. Interrater and intrarater agreement for both grading schemes were calculated using kappa (κ) statistics.

Interrater agreement was highly significant, yielding κ-values at 95% CI ($p = 0.000$) of 0.225 for the first [0.185; 0.265] and 0.368 s [0.328; 0.408] time points for 2D-DSA and values of 0.700 for the first [0.654; 0.745] and 0.776 s [0.729; 0.822] time points for 3D-DSA. Intrarater agreement demonstrated κ-values between 0.139 and 0.512 for 2D-DSA and between 0.487 and 0.813 for 3D-DSA scores.

Interrater and intrarater agreement was minimal or weak for 2D-DSA scores, but strong for 3D-DSA

scores. Halter et al. proposed that baseline 3D-DSA characterization may prove more reliable when categorizing clipped IA remnants for purposes of risk stratification and lifelong follow-up [2].

Systematic review and meta-analysis

A PRISMA-guided systematic literature review of the MEDLINE and Cochrane Library databases and meta-analysis was completed. Studies were included that detailed rates of aneurysm wrapping, residual confirmed with imaging, and regrowth after confirmed total occlusion. Pooled rates were subsequently calculated using a random-effects model. An assessment of statistical heterogeneity and publication bias among the included studies was also completed for each analysis, with resultant I2 values and p values determined with Egger's test.

Sixty-four studies met the inclusion criteria for final analysis. In 41 studies, 573/15,715 aneurysms were wrapped, for a rate of 3.5% (95% CI 2.7%-4.2%, I2 = 88%). In 43 studies, 906/13,902 aneurysms had residual neck or dome filling, for a rate of 6.4% (95% CI 5.2%-7.6%, I2 = 93%). In 15 studies, 71/2568 originally fully occluded aneurysms showed regrowth, for a rate of 2.1% (95% CI 1.2%-3.1%, I2 = 58%). Together, there was a total rate of noncurative surgery of 12.0% (95% CI 11.5%-12.5%). Egger's test suggested no significant publication bias among the studies. Meta-regression analysis revealed that the reported rate of aneurysm wrapping has significantly declined over time, whereas the rates of aneurysm residua and recurrence have not significantly changed.

Open microsurgery for cerebral aneurysm results in noncurative treatment approximately 12% of the time. This metric may be used to counsel patients and as a benchmark for other treatment modalities. This investigation is limited by the high degree of heterogeneity among the included studies [3].

Risk Factors

The aim of a study is to identify the risk factors for clip remnants requiring retreatment and/or exhibiting growth.

All consecutive patients with primary aneurysm clipping performed at University Hospital of Essen between January 1, 2003, and December 31, 2013, were eligible for this study. Aneurysm occlusion was judged on obligatory postoperative digital subtraction angiography and the need for repeated vascular control. The identified clip remnants were correlated with various demographic and clinical characteristics of the patients, aneurysm features, and surgery-related aspects. RESULTS Of 616 primarily clipped aneurysms, postoperative angiography revealed 112 aneurysms (18%) with clip remnants requiring further control (n = 91) or direct retreatment (n = 21). Seven remnants exhibited growth during follow-up, whereas 2 cases were associated with aneurysmal bleeding. Therefore, a total of 28 aneurysms (4.5%) were retreated as clip remnants (range 1 day to 67 months after clipping). In the multivariate analysis, the need for retreatment of clip remnant was correlated with the aneurysm's initial size (> 12 mm; OR 3.22; p = 0.035) and location (anterior cerebral artery > internal carotid artery > posterior circulation > middle cerebral artery; OR 1.85; p = 0.003). Younger age with a cutoff at 45 years (OR 33.31; p = 0.004) was the only independent predictor for remnant growth. CONCLUSIONS The size and location of the aneurysm are the main risk factors for clip remnants requiring retreatment. Because of the risk for growth, younger individuals (< 45 years old) with clip remnants require a long-term (> 5 years) vascular follow-up. Clinical trial registration no: DRKS00008749 (Deutsches Register Klinischer Studien) [4].

Treatment

The presence of an aneurysm remnant after incomplete or unsuccessful surgical clipping is associated with persistent risk of regrowth and rupture, and additional treatment is generally recommended. Attempts at surgical re-exploration are technically difficult and carry significant risk. Endovascular therapy can represent a valuable therapeutic alterative in these cases. Endovascular coil occlusion of postsurgical aneurysm remnants is a safe and efficacious therapeutic alternative in selected cases. Postoperative angiography to identify aneurysm remnants that may be amenable to endovascular treatment should be considered in all patients [5)]

Case series

The aim of a prospective study, carried out in a consecutive series of 305 microsurgically clipped aneurysms, was to check the absence of an aneurysmal remnant on post-operative angiography, and if a remnant was found to quantify its size in order to consider additional clipping to avoid the risk of rebleeding. Out of the 305 aneurysms, 292 (96%) were located in the anterior and 13 (4%) in the posterior circulation. Post-operative angiography was performed on average two weeks after surgery. Determination of the presence or not of an aneurysmal remnant and its quantification was done by an independent observer (JCA). Aneurysmal remnants were classified into 5 grades: grade I: less than 50% of neck size, grade II: more than 50% of neck size, grade III: residual lobe of a multilobulated sac, grade IV: residual sac of less than 75% of aneurysmal size and grade V: residual sac of more than 75% of aneurysmal size. Correlations between presence (and size) of the remnant and anatomical-surgical data obtained from the operative report were studied. Clipping was considered incomplete in 18 of the 305 aneurysms (5.9%). The group with residual neck only (grade I = 8 cases, Grade II = 4 cases) amounted to 4% of the whole series, whereas the group with residual neck + sac (grade III = 4, grade IV = 1, Grade V = 1) to 1.9%. Only the Sindou residual grading system 5 was amenable to re-operation for complementary clipping without creating a stenosis of the parent artery. Our results are in the range of those of other published series. Anatomical-surgical factors for predisposition to incomplete clipping are discussed. The rates of sac obliteration using microsurgical clipping are to be compared with those recently achieved by electrically detachable coiling. The classification which we have developed is proposed for future comparison with endovascular results [6)].

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