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Clipping versus coiling for intracranial aneurysms

Marcin Birski [a,*], Cezary Wałęsa [b], Witold Gaca [b], Dariusz Paczkowski [a], Julita Birska [a], Aleksandra Harat [c]

[a] Neurosurgery Department, 10th Military Research Hospital, Bydgoszcz, Poland
[b] Radiology Department, 10th Military Research Hospital, Bydgoszcz, Poland
[c] Department of Public Health, Nicolaus Copernicus University, Ludwik Rydygier Collegium Medicum, Bydgoszcz, Poland

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ABSTRACT

Background and purpose: The aim of this study was to compare results of clipping and coiling for aneurysms of the anterior circle of Willis. Previous studies have not identified a clear superiority of one method over the other.

Material and methods: The study group included 165 consecutive patients. The assessment took into account the risk of death, neurological status according to the scale of the GOS and mRS, the incidence of early complications and quality of life measured by own surveys and questionnaire EORTC QLQ-C30 v. 3.0.

Results: Mean follow-up was more than four years. Early and late results of treatment after embolization and clipping for all patients did not differ. Evaluation of patients with bleeding aneurysms demonstrated better outcomes after embolization, however statistical significance was observed only in terms of symptomatic scale score of QLQ-C30 questionnaire ($p = 0.02$). For patients with non-bleeding aneurysms better outcomes were obtained after clipping, but statistical significance was found only in the early results: more excellent results in GOS score at discharge ($p < 0.03$) and fewer complications during hospitalization ($p = 0.02$).

Conclusions: Results of treatment after clipping and coiling do not differ in total for all patients, but differ depending on the presence of bleeding. Patients with bleeding aneurysms achieve better outcomes after coiling, and patients with non-bleeding aneurysms achieve better outcomes after clipping.

1. Introduction

Owing to the development of the vascular neurosurgery in the middle of the 20th century clipping has become an unrivalled method of treating intracranial aneurysms [1]. The new revolution has been brought about by the introduction of the detachable coils in 1990 by Guido Guglielmi and the Boston Scientific company briefly called GDC (Guglielmi Detachable Coils) [2]. In the following years there was a rapid development

* *Corresponding author at*: Marcin Birski, Klinika Neurochirurgii, 10 Wojskowy Szpital Kliniczny, ul. Powstańców Warszawy 5, 85-681 Bydgoszcz, Poland. Tel.: +48 604255816; fax: +48 523787094.
E-mail address: mbirski@poczta.fm (M. Birski).

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and popularization of the endovascular embolization in the treatment of cerebral aneurysms supported by technical progress with regard to the structure of the coils and the methods of their application. The introduction of stents, first described by Higashida in 1997, has additionally broadened the possibilities and the range of the indications as to the treatment [3]. Coiling, initially treated as a complementary method applied in cases of limited possibilities of surgical treatment, has not only become competitive but in certain fields started to substitute clipping. Contemporarily, in the majority of cases the primary aim of treating aneurysms which is the protection from bleeding may be obtained both by clipping and coiling. The advantage of the embolization is a shorter time of the procedure, a reduction of typical surgical complications such as infections or bleeding and the unnecessity of the brain compression and its aftermaths. The less permanent effect of treatment and, consequently, more frequent necessity of repeating intervention are considered to be the biggest disadvantages of coiling [4,5]. Moreover, more frequently aneurysms initially planned for endovascular treatment are eventually clipped than the other way round [6,7]. In case of certain complications after embolization, namely uncontrolled dislocation of coils from the aneurysm sack to the artery, the surgical intervention may give a chance to level the negative sequelae [8]. For these reasons, regardless of the increasing quality and rapid improvement of endovascular techniques there are no prognoses for classical surgical methods to be displaced.

The growing experience of applying both methods has allowed to elaborate certain preferences as to the choice of the treatment. The localization of the lesion plays a particularly significant role. In neurosurgery, with regard to the differences in the difficulty of accessing, a division into an anterior and posterior part of the circle of Willis has been commonly accepted. The superiority of embolization has been naturally and indisputably acknowledged for the aneurysms of the posterior part of the circle which are significantly harder to access surgically. Noticeable tendencies that differentiate the results of treatment are also formed with regard to such parameters as the size of the aneurysms, the age of the patients, their initial condition and more specific localizations, yet they contemporarily remain more as observations than certainties [4,5,9–11]. On the contrary, in case of the aneurysms located in the anterior part of the circle of Willis, there are no premises indicating the predominance of either method. Certainly, there are comparisons presenting better results after embolization; nevertheless, their critical analysis and the assessment of late results throw doubt on such unambiguous conclusions. Alike is the case of ISAT – currently the biggest and the most well-known prospective study which directly compares the results of treating bleeding aneurysms with clipping and endovascular embolization [12,13]. There are some randomized trials concerning bleeding aneurysms, however the number and quality of studies comparing the results of treatment of unruptured aneurysms is insufficient. For these reasons, apart from the aneurysms occurring in the posterior part of the circle, the choice between the endovascular embolization and clipping as the optimal form of treatment remains opened.

The aim of this research was to compare the early and late results of treating intracranial aneurysms located in the anterior part of the circle of Willis with the use of two different methods: clipping and endovascular embolization. An attempt has been undertaken to answer the question whether the results of the treatment with these methods vary and if they depend on the presence or absence of bleeding from the aneurysm.

2. Materials and methods

The assessment embraced all 165 consecutive patients treated for aneurysms located in the anterior part of the circle of Willis in the years 2003–2008. In 24 cases more than one aneurysm was treated in one patient. Twelve patients underwent more than one procedure (from 2 to 4). Three patients were excluded: two of them with non-bleeding aneurysm treated with both endovascular and surgical methods and one person with unfavourable results of simultaneous treatment of the ruptured basilar artery aneurysm.

The decision about the type of therapy was taken by the neurosurgeon on the basis of the evaluation of the condition of the patients, the results of the imaging, the opinion of the interventional neuro-radiologist and the choice of the patients themselves, if their condition allowed for a conscious consent. In some cases the choice of the method was limited by its availability. The technical limitations always concerned coiling, never clipping.

The study evaluated the outcome of patients instead of particular aneurysms. For the assessment the Glasgow Outcome Scale (GOS) [14] and the modified Rankin scale (mRs) [15] were applied. For estimating the quality of life the quality of life questionnaire EORTC QLQ-C30, version 3.0 [16,17] was employed as well as a self-created survey which included questions about the change in the overall health condition after treatment, coming back to work and other possible changes in the social functioning. The condition on the day before the intervention or the day of the intervention was assumed to be the initial condition whereas the treatment results were estimated for two periods: the condition on the last day of hospitalization and the condition after at least one year from the procedure. The grades 4 and 5 on the GOS scale and 0, 1 and 2 on the mRs scale were assumed as a "good" result. The "death" result corresponded with the grade 1 on the GOS scale and 6 on the mRs scale. Due to the expected significant majority of good results in the treatment of non-bleeding aneurysms another group has been distinguished of "very good" results embracing the grade of 5 on the GOS and 0 and 1 on the mRs scale. For the assessment of the early complications all significant, undesirable events were acknowledged, not only those which could be directly related with the given procedure. The complications which were conceived as significant were those that did not abate before being discharged and influenced the functioning of the patients.

The shortest time of observation was 19 months and the longest 94 months. The middle time was 52.2 months (SD $\pm$ 19.2), which is more than 4 years. The majority of the group (69.8%; $n = 113$) were women. The age varied from 21 to 78 years, 51.9 years on average (SD $\pm$ 10.4, median = 52 years). The examined group contained 86 patients with bleeding and 76 patients with non-bleeding aneurysms. Among 48 patients coiling was performed and among 114 patients the aneurysms were clipped.