Guglielmi detachable coil embolization of posterior circulation aneurysms: a systematic review of the literature
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Authors' objectives
To assess Guglielmi detachable coil (GDC) embolisation in the treatment of patients with posterior circulation aneurysms. This included the type of lesions treated, the degree and durability of occlusion, and the short-term clinical outcome of the procedure. This abstract summarises the clinical outcomes, not the measures of technical success.

Searching
MEDLINE was searched from 1990 for English language literature; the search terms were reported. The bibliographies of the studies identified were used to find additional studies.

Study selection
Study designs of evaluations included in the review
This was a review of single-centre cohorts. At least 10 patients had to be treated for a study to be included. The included studies were retrospective analyses (in only one study were the data collected prospectively).

Specific interventions included in the review
Studies of embolisation using the GDC were eligible for inclusion. The included studies used platinum coils.

Participants included in the review
Studies of patients with posterior circulation aneurysms were eligible for inclusion. Studies were included if the majority of the patients were treated for saccular aneurysms that were not associated with an arteriovenous malformation nidus. Studies in which a minority of the patients were treated for other types of aneurysms were also included. Studies that did not report the type of aneurysms treated were excluded. The studies included in the analysis were of patients with aneurysms exclusive to the posterior circulation. The majority of patients (81.2%) presented with unruptured aneurysms or in good clinical condition.

Outcomes assessed in the review
Studies were included if they reported data on efficacy and complications that could be attributed to posterior circulation lesions. The outcomes reported in the review included: procedural and non-procedural complications; procedural and overall mortality within 30 days; procedural and non-procedural morbidity within 30 days; incidence of postembolisation subarachnoid haemorrhage (SAH); and the patients’ independence status at follow-up. Procedural complications were classified as intra-operative rupture, coil protrusion, parent vessel thrombosis, embolism, or dissection (more detailed definitions were given in the report). The degree and durability of occlusion were also reported, but are not summarised in this abstract.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The reviewers assessed the criteria used to select the study population, whether the data collection was prospective or retrospective, and the loss to follow up. Information relevant to validity was collected as part of the data extraction procedure, which was carried out by one reviewer using a standardised form.

Data extraction
One reviewer extracted the data using a standardised form. Data were extracted to allow intention-to-treat assessment of
complications, morbidity and mortality. Data pertaining to the patients' independence status were dichotomised as independent (Rankin Scale 0-2, Glasgow Outcome Scale 1-2) or dependent (Rankin Scale 3-5, Glasgow Outcome Scale 3-4).

Methods of synthesis
How were the studies combined?
Data from all of the included studies were given equal weight and pooled to obtain overall percentages for each outcome. Procedural mortality was analysed as a subset of total mortality within 30 days. The annual risk of SAH was calculated as the number of postembolisation haemorrhages divided by the total duration of follow-up (years). Treatment failures and patients lost to follow-up were not included when calculating the risk of SAH.

How were differences between studies investigated?
Studies exclusive to the basilar apex were analysed separately from studies that included posterior circulation aneurysms at all locations (including the basilar apex).

Results of the review
Eighteen studies (1,024 patients, 728 aneurysms in the posterior circulation) met the inclusion criteria. Six of these studies were excluded from the analysis because of insufficient reporting of data. The remaining 12 studies (489 patients, 495 aneurysms in the posterior circulation) were analysed.

Basilar apex (6 studies, 226 patients, 228 aneurysms).
Thirty-two (14%) patients experienced procedural complications, the most common of which were coil protrusion and parent vessel thrombosis. The non-procedural complications reported were cerebral vasospasm in 26 out of 154 SAH patients in four studies; hydrocephalus in 29 out of 76 patients in two studies; and pulmonary embolism and renal failure in one study. Procedural morbidity occurred in 15 (6.6%) patients; procedural mortality was 1.3% (3 patients). Overall, 10 patients died within 30 days (4.4%). There were three post-GDC SAH events among 221 patients representing 5,390.6 months of follow-up. The estimated annual risk of SAH after embolisation was 0.7%. The follow-up of 190 patients (representing 4,955.6 months of observation) found that 159 (83.7%) were independent, 13 were dependent and 18 had died.

Posterior circulation (6 studies, 263 patients, 267 aneurysms).
Thirty (11.2%) patients experienced procedural complications, the most common of which was parent vessel thrombosis. The non-procedural complications reported were cerebral vasospasm in 3 patients in three studies, and medical complications in 7 patients in two studies. Procedural morbidity occurred in 12 (4.5%) patients; procedural mortality was 1.5% (4 patients). Overall, 23 patients died within 30 days (8.6%). There were three post-GDC SAH events among 239 patients representing 4,018.8 months of follow-up. The estimated annual risk of SAH after embolisation was 0.9%. The follow-up of 260 patients (representing 4,018.8 months of observation) found that 223 (85.8%) were independent, 11 were dependent and 26 had died.

Data for the degree and durability of occlusion were available in the paper.

Authors’ conclusions
The authors concluded that the role of coil embolisation in the treatment of unruptured posterior circulation aneurysms was unclear. This appears to have been based on the marginal reduction observed in the annual risk of SAH, compared with the natural history of unruptured aneurysms. The authors also stated that coil embolisation was unquestionably effective in preventing early rebleeding from ruptured aneurysms.

CRD commentary
The inclusion criteria for the intervention, participants and outcomes appear to be clearly defined and the review purposely set out to review data from single-centre cohorts. The search for studies was not extensive and English
language bias may have further increased the possibility that some relevant data were not identified. Rigorous methods to minimise bias in the study selection process and errors in the data extraction were not reported. The assessment of aspects of study quality gave an overall impression of the limitations of the data, which was probably the best use that could be made of the information on study quality in this particular review. Practitioners will need to decide whether the details provided on patient characteristics and aneurysms treated are sufficient to inform their clinical decision-making. The analysis was simply the sum of events across studies without a formal assessment of heterogeneity (differences) between the studies. This could hinder decision-making about applicability.

The evidence presented supports the authors' conclusion concerning unruptured aneurysms. The authors' conclusion concerning the prevention of early rebleeding from ruptured aneurysms appears to have been based largely on data from sources other than this review.

**Implications of the review for practice and research**

Practice: The authors stated that they hoped this review would serve as an interim benchmark for evaluating the safety and efficacy of GDC embolisation for posterior circulation aneurysms.

Research: The authors stated that further studies are needed to confirm their conclusions and that these studies will need to use standardised methods of outcome assessment and data presentation.

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