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Institute of Health Economics and Clinical Epidemiology
University Hospital of Cologne

EE425

Economic Modelling of Web Embolization vs Coiling vs Stent-Assisted Coiling for the Endovascular Treatment of Unruptured Intracranial Aneurysms

Simões Correa Galendi J[1], Goertz L[2], Kabbasch C[2], Schlamann M[2], Stock S[1], Müller D[1], Grosse-Hokamp N[2]

[1] Institute of Health Economics and Clinical Epidemiology, Faculty of Medicine and University Hospital of Cologne, University of Cologne, Cologne, Germany

[2] Department of Radiology and Neuroradiology, Faculty of Medicine and University Hospital of Cologne, University of Cologne, Cologne, Germany.

Background

Because of the widespread use of imaging modalities, unruptured intracranial aneurysms (UIAs) are detected with increasing frequency. In Germany, the number of patients who were admitted to the hospital for an UIA increased by a factor of 2.3 from 2005 to 2017.[1]

The rupture of an intracranial aneurysm leads to subarachnoid hemorrhage (SAH), which is associated with high morbidity and mortality.[2] To reduce the risk of rupture and SAH, endovascular treatment is the treatment of choice for UIAs. Conventional coiling is an established technique for endovascular aneurysm treatment, but novel endovascular techniques have been developed. First, Stent-assisted coiling (SAC) allows the treatment of morphologically complex aneurysms and can provide higher aneurysm occlusion rates than conventional coiling.[3] However, SAC is associated with an increased risk for ischemic stroke.[3] Second, Woven Endobridge (WEB) is a technique that promotes intrasaccular flow-disruption developed for the treatment of wide-necked bifurcation aneurysms.[4] Treatment with WEB does not require long-term anti-platelet medication, which represents an advantage over SAC.[4]

Objective

To assess the cost-effectiveness of WEB treatment versus coiling versus SAC for the treatment of UIAs from the perspective of the German Statutory Health Insurance (SHI).

Methods

A patient-level simulation with a life-long time horizon and a 6-month cycle length was developed to reflect and compare the clinical and economic long-term consequences of coiling, SAC and WEB.

Model population: 55-year-old patients (standard deviation: 10.2), 67% female and 33% male, who have a single UIA located at the middle cerebral artery (MCA) with saccular shape and an aneurysm diameter between 3 and 11 mm.

The simulation model incorporated the relevant events that may occur to patients with UIAs after endovascular treatment and is presented in figure 1. Recurrence (i.e., aneurysm regrowth or recanalization after a successful aneurysm occlusion) was assumed to occur in the first five years after the first treatment. Coiling was considered as retreatment option for remnant or recurrent aneurysms, independent of the initial treatment.

Incremental cost-effectiveness ratios (ICERs) were calculated as costs per quality-adjusted life years (QALYs) and costs per year with neurologic morbidity avoided. Deterministic and probabilistic sensitivity analyses (DSA and PSA) were conducted.

Model overview

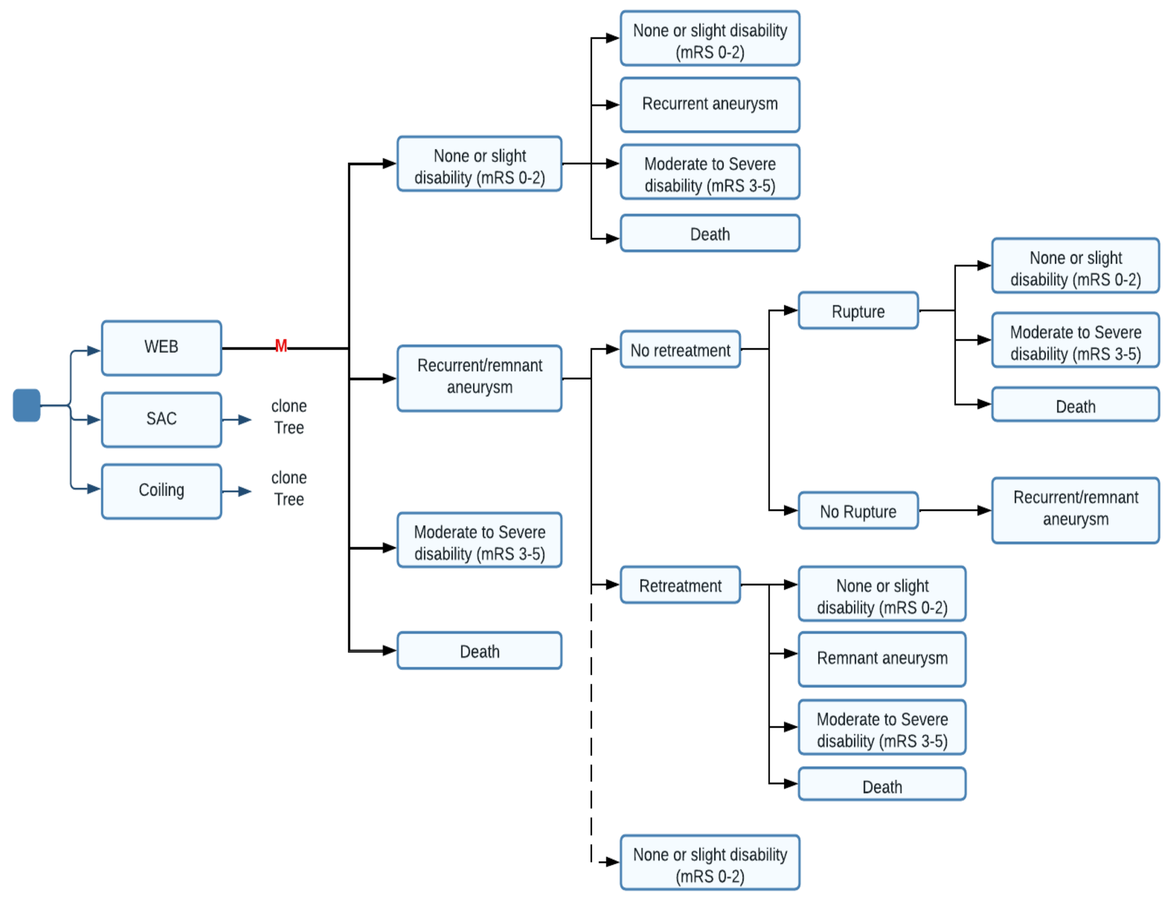

Figure 1. Model overview. M indicates start of microssimulation; dashed line represents the possibility of a progressive occlusion (transition was possible only in the first 6-month cycle); mRS: modified Rankin Scale.

Results

Base Case

- Lifetime costs were 20,440€ for the WEB, 23,167€ for SAC, and 8,200€ for coiling. Lifetime QALYs were 13.24 for the WEB, 12.92 for SAC and 12.68 for coiling.
- Compared to coiling, the ICER for the WEB was 21,826 €/QALY, while SAC was absolutely dominated by WEB. WEB and coiling strategies avoided 14.95 and 14.50 years of neurologic morbidity, respectively.
- SAC strategy resulted in 14.38 years of neurologic morbidity avoided, hence being absolutely dominated by the other two strategies. Compared to coiling, the ICER for the WEB was 27,112 € per neurologic morbidity avoided.

Sensitivity analyses

- DSA showed that the discount rate, material costs and retreatment rates had the largest impact on the ICERs.
- PSA showed that at a willingness-to-pay of ≥30,000€/QALY, WEB was the preferred treatment, otherwise coiling would be still the most cost-effective strategy (Figure 2).

Cost-Effectiveness Acceptability Curve

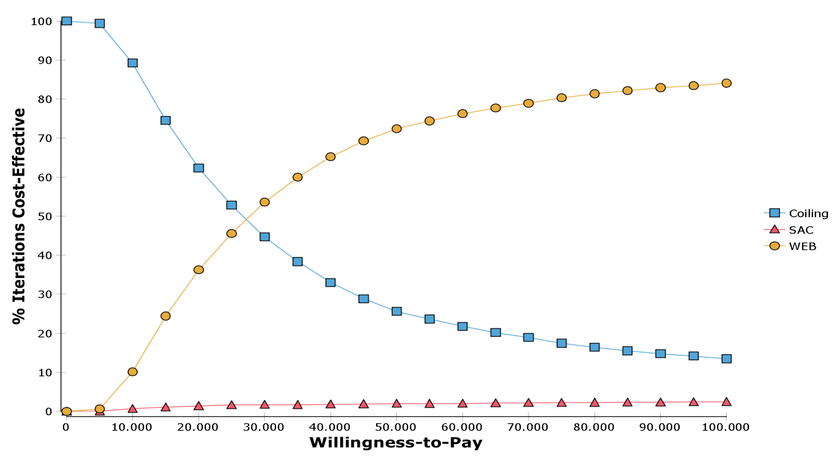

Figure 2. Cost-effectiveness acceptability curve. Willingness-to-pay in € per QALY.

Discussion

- These findings are only valid for saccular aneurysms between 3-11 mm in diameter. SAC is also indicated for fusiform, lobulated and partially thrombosed aneurysms and vessel branches arising from the aneurysm sac, which are not amenable with coiling or WEB.[3]
- The WEB might be a cost-effective technique compared to alternative endovascular treatment options. SAC should be considered as treatment option for complex aneurysms not amenable to either coiling or WEB.

References

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