

Factors that Predict Poor Outcome after Treatment of Un-Ruptured Anterior Communicating Artery Aneurysms

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BACKGROUND

A cerebral aneurysm is a localized dilation or ballooning of an artery or vein in the brain due to weakness in the blood vessel wall. Aneurysms can occur in various blood vessels, including the anterior communicating artery (ACOM), which is a relatively small artery that connects the two anterior cerebral arteries. Management strategies for ACOM aneurysms that have not ruptured are variable. Depending on various factors, the aneurysm could be left untreated and the dilation of the blood vessel can simply be monitored. If treatment is elected for, then the aneurysm can either be clipped (a clip is placed across the neck of the aneurysm to prevent it from bleeding or rupturing) or coiled (tiny coils are placed in the aneurysm to promote clotting and close of the aneurysm) (Fig. 1). When treatment is opted for, various pre-operative and peri-operative factors are thought to affect the outcome, but no measure exists for which of these factors contribute most to a poor post-treatment outcome.

OBJECTIVE

The objective of this study was to identify demographical information, presentation indices, and clinical information that could help predict poor patient outcome after undergoing treatment for an un-ruptured ACOM aneurysm.

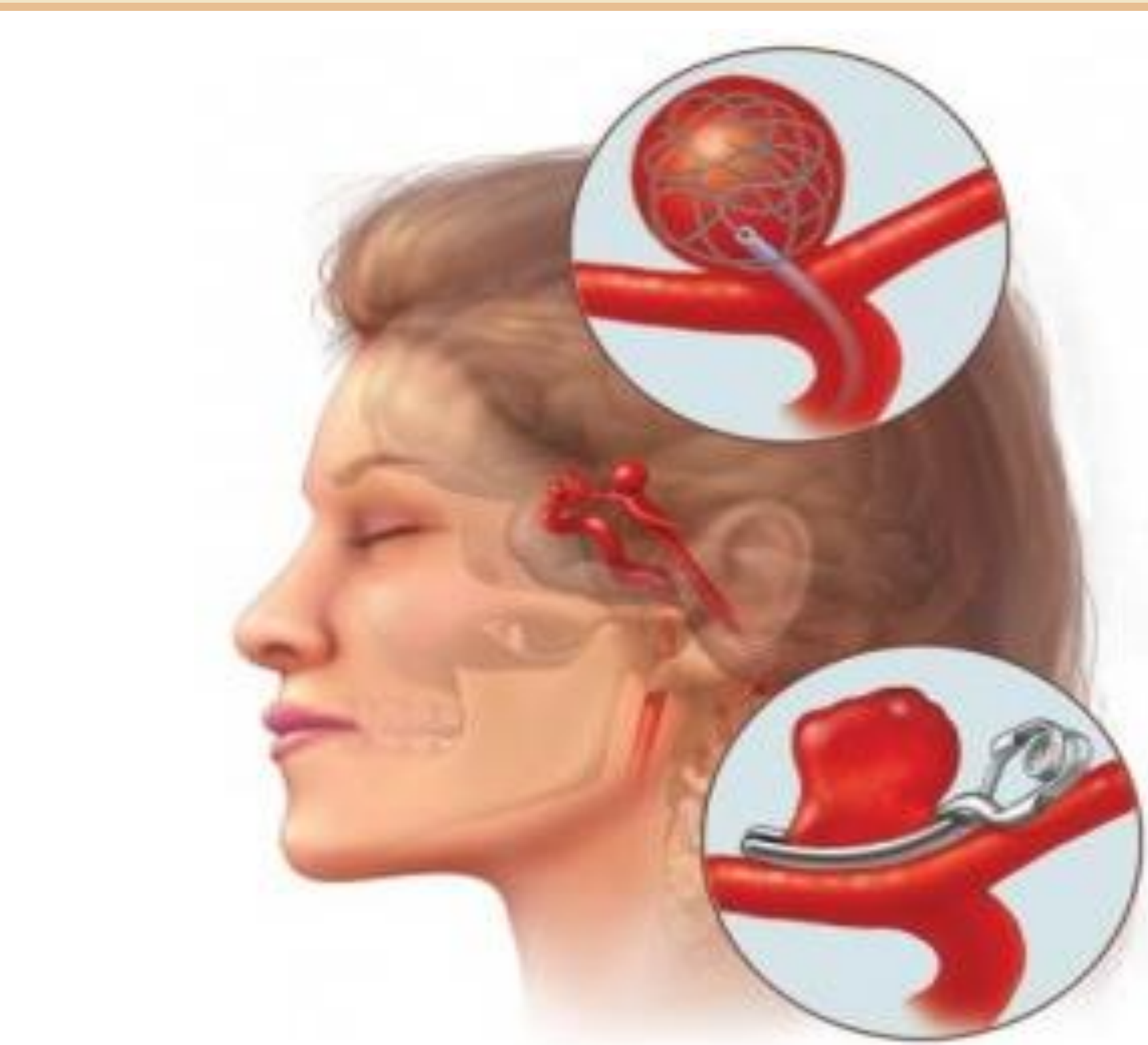


Figure 1: The diagram above depicts coiling and the diagram below depicts clipping.

METHODS

The study was performed as a retrospective review of 139 patients with un-ruptured ACOM aneurysms, from 2007 to 2012, who underwent either microsurgical clipping or endovascular coiling to treat the aneurysm. Demographics, medical history, presenting clinical condition, and health outcomes were analyzed. The outcome of the treatment was quantified using the Glasgow Outcome Score. A score of 3 or greater at discharge was considered a poor outcome whereas a score of less than 3 was considered a favorable outcome. Multivariate regression analysis was used to identify significant predictors of poor outcome. Furthermore, the types of deficits endured by patients with poor outcomes were tabulated and the frequencies of the different types of deficits were calculated.

RESULTS

A favorable outcome at discharge was achieved in 116 of the 139 total patients (83.45%). The remaining 23 patients had poor outcomes. Multivariate analysis identified patient age greater than 70 ($p < 0.005$), a history of prior brain injury or surgery ($p < 0.005$), current, but not previous, smoking ($p < 0.05$), giant aneurysms of a size greater than 20mm ($p < 0.05$), a duration of temporary occlusion greater than 20 minutes ($p < 0.001$), and the use of microsurgical clipping ($p < 0.005$), as significant predictors of poor outcome. Also, the types of deficits that most commonly occurred subsequent to treatment of ACOM aneurysms were analyzed. This yielded the result that the most common type of deficit resulting from an ACOM aneurysm was cognitive (39.13%), followed by motor (26.07%). An additional point of note is that all patients who suffered from post-operative cognitive deficits underwent microsurgical treatment, and not endovascular treatment.

	Total in Population (%)	Total in Patients with GOS discharge of < 3 (%)	Total in Patients with GOS discharge of ≥ 3 (%)
Gender			
Male	60 (43.17%)	51 (43.97%)	9 (39.13%)
Female	79 (56.83%)	93 (56.03%)	14 (60.87%)
Mean Age	59.22 years	58.84 years	61.13 years
Age > 70	25 (17.99%)	18 (15.52%)*	7 (30.43%)
Hypertension	94 (67.73%)	76 (65.52%)	18 (78.26%)
Smoking (Current)	43 (30.93%)	33 (28.45%)*	10 (43.48%)
Smoking (Remote)	59 (42.45%)	52 (44.83%)	7 (30.43%)
Smoking (Never)	37 (26.62%)	31 (26.72%)	6 (26.09%)
Mean Aneurysm Size	6.77 cm	6.23 cm	9.52 cm
Giant Aneurysm (≥ 20mm)	11 (7.91%)	7 (6.03%)*	4 (17.39%)
Type of Treatment			
Microsurgery	94 (67.63%)	74 (63.79%)*	20 (86.96%)
Endovascular	46 (32.37%)	43 (36.21%)*	3 (13.04%)
Prior Brain Injury	58 (41.73%)	44 (38.39%)*	14 (60.87%)
Peri-Operative Complications	11 (7.91%)	6 (5.36%)	5 (21.74%)
Mean Time of Temporary Occlusion	13.23 min	6.87 min*	36.33 min

Table 1: Characteristics of Patients with Un-ruptured Anterior Communicating Artery Aneurysms (2007-2012). The total population consisted of 139 patients, with 116 of them receiving a GOS of less than 3 at discharge and 23 of them receiving a GOS ≥ 3 at discharge. The * indicates factors that differed significantly between patients that received GOS discharge < 3 and those that received GOS discharge ≥ 3 .

Type of Deficit	Total in Patients with GOS discharge of ≥ 3
Motor	6 (26.07%)
Sensory	3 (13.04%)
Visual	2 (8.70%)
Speech	2 (8.70%)
Balance	1 (4.35%)
Headaches	5 (21.74%)
Seizures	2 (8.70%)
Cranial Nerve Palsy	1 (4.35%)
Cognitive	9 (39.13%)
Endovascular	0 (0.00%)
Microsurgery	9 (100.00%)

Patient	Description of Cognitive Deficit
Patient 1	Poor judgement, problem-solving, reasoning, memory deficiency.
Patient 2	Memory loss
Patient 3	Underlying confusion, requires repeated prompting to answer questions. Impaired cognition, memory.
Patient 4	Problems with short-term memory, problems with simple math, verbal problem solving. Severe problem with verbal learning, letter recognition.
Patient 5	Significant cognition and memory problems that cleared up over time
Patient 6	Transient memory loss, impaired cognition
Patient 7	Some confusion
Patient 8	Attention and memory deficits, some confusion that improved over a few nights
Patient 9	Confusion, Oriented X 1 only

Table 3: Nine patients with GOS discharge ≥ 3 experienced some kind of cognitive deficit.

Table 2: Classification of Deficits experienced by patients who received a GOS of 3 or greater at the time of discharge (2007-2012). The population consisted of 23 patients. Patients who experienced multiple types of deficits were counted multiple times, for each category of deficit that he/she experienced.

CONCLUSION

Age over 70, prior history of brain injury, current smoking, and an aneurysm size greater than 20mm, along with the use of clipping, and a duration of temporary occlusion greater than 20 minutes are the strongest predictors of a poor outcome from treatment of unruptured ACOM aneurysms. In addition, patients who are treated for unruptured ACOM aneurysms are more at risk for cognitive defects than any other type of defect. This would indicate that treatment should be reconsidered in patients with any of the above risk factors, and coiling should be attempted whenever possible to minimize the risk of cognitive defects.