

Introduction

Unruptured intracranial aneurysms (UIAs) exist in 2% of the North American population. Results from observational studies suggest patients with small anterior circulation UIAs are at low risk for subarachnoid hemorrhage (SAH). Thus, many practitioners have adopted a conservative approach towards managing these lesions, comprised primarily of observation and surveillance imaging. However, the incidence and risk factors which underlie growth of UIAs or de novo aneurysm formation require further investigation. Here, we report our experience with an aneurysm surveillance protocol in 192 appropriately selected patients to retrospectively identify risk factors and annual risk for UIA growth or de novo aneurysm formation.

Methods

We retrospectively identified 192 patients with 234 UIAs that were recommended for observation with surveillance imaging and obtained at least 1 follow-up study over an 11.5 year period. The incidence of UIA growth and de novo aneurysm formation was assessed. Risk factors for UIA growth and de novo aneurysm formation were evaluated. Patient compliance with the surveillance protocol was additionally recorded.

Results

Over 793 aneurysm-years of follow-up, 28 of 234 UIAs grew resulting in an annual risk of growth of 3.7%. At 6-months, 5.2% of patients had demonstrated growth of their aneurysm. Initial aneurysm size was the only predictor of aneurysm growth ($p=0.002$), with growth seen in 1.6% of UIAs < 5mm vs 8.7% for UIA > 5mm per aneurysm year. In addition, de novo formation of 4 aneurysms was captured during the surveillance period, resulting in a 0.6% annual risk of de novo aneurysm formation over 621 years of patient follow-up.

The rate of aneurysm growth or de novo aneurysm formation was 5.0% per patient-year. Patient compliance with the surveillance protocol was 65%. Older patients were less likely to be compliant with each additional year of age decreasing compliance by 3% ($p = 0.01$).

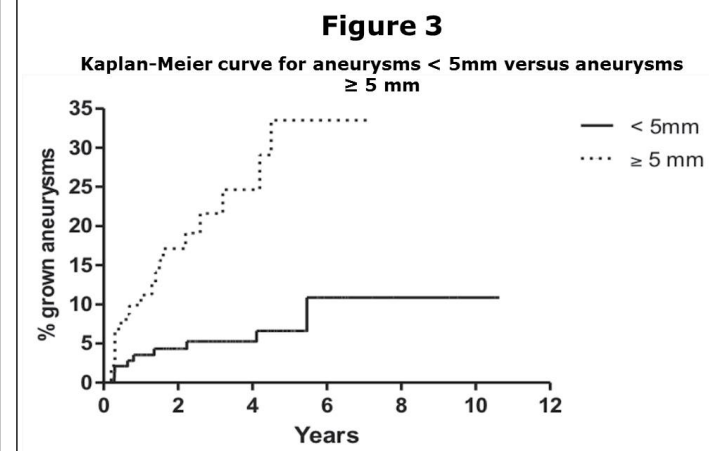
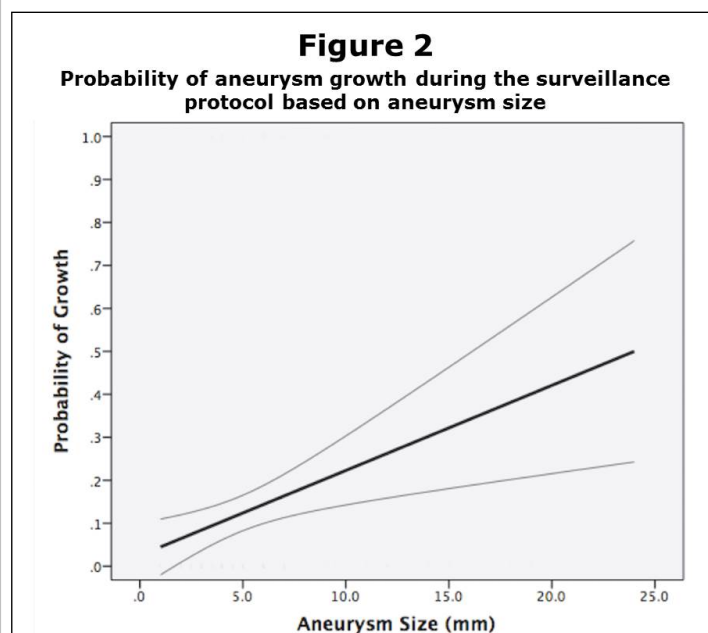
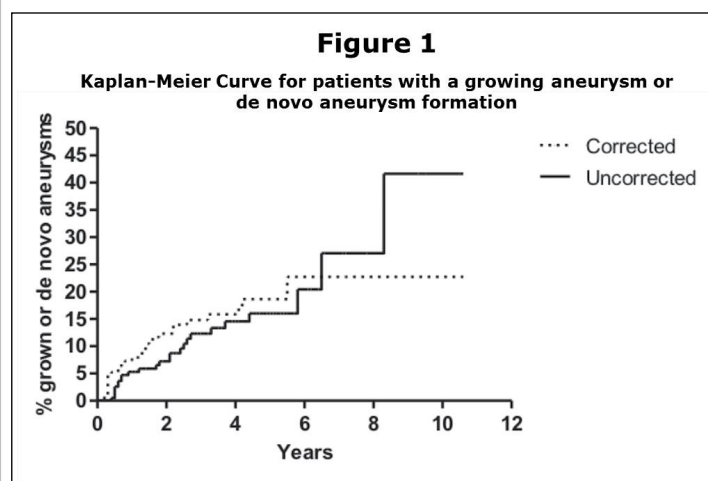


Table 1
Baseline aneurysm characteristics and associated risk for growth or de novo aneurysm formation

Baseline Characteristic/ Risk Factor	n	Patients w/ Growing or de Novo Aneurysm (%)	Patient w/o Growing or de Novo Aneurysm (%)	Odds Ratio	95% CI	p-value
Aneurysms Location	234	28 (12.0)	206 (88.0)			
Acom/ACA	44 (18.9)	3 (6.8)	41 (93.2)	-	-	-†
ICA	80 (34.2)	11 (13.8)	69 (86.2)	2.47	0.60-10.1	0.21
Pcom	21 (9.0)	3 (14.3)	18 (85.7)	2.67	0.46-15.4	0.27
MCA	67 (28.6)	7 (10.4)	60 (89.6)	1.38	0.30-6.30	0.68
Posterior	22 (9.4)	4 (18.1)	18 (81.9)	2.73	0.50-14.8	0.25
Aneurysm Size						
<3 mm	48 (20.5)	1 (2.1)	37 (97.9)	1.15	1.05-1.27	0.0024 §
3-6 mm	146 (62.4)	18 (12.3)	128 (87.7)			
7-11 mm	32 (13.7)	8 (25.0)	24 (75.0)			
12-24 mm	8 (3.4)	1 (12.5)	7 (87.5)			
≥25 mm	0	0	0			
Multiplicity				0.87	0.35-2.20	0.77
Yes	73 (31.2)	8 (11.0)	65 (89.0)			
No	161 (68.8)	20 (12.4)	141 (87.6)			

Conclusions

Observation of low risk UIAs with surveillance imaging may be safely implemented with good adherence, particularly in younger patients. Aneurysm size is the only predictor of future growth in this cohort. Furthermore, we report a high rate of early growth in surveilled UIAs, and a higher rate of growth in UIAs > 5 mm. Thus, we propose the implementation of more frequent surveillance imaging in these populations to help reduce the risk of SAH due to an undetected growing UIA.