Treatment outcomes of unruptured ARUBA-eligible cerebral arteriovenous malformations at Cleveland Clinic

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Introduction

The guidelines for treating unruptured cerebral AVMs remain controversial. The multi-institute ARUBA trial reported lower risk of stroke or death with conservative medical management compared to intervention at the 3 year follow-up time point. There were numerous limitations to the study, however, and subsequent studies have reported lower rates of stroke and death than the ARUBA trial. We conducted this retrospective study to determine the risk of stroke and death in unruptured ARUBA-eligible AVM patients following invasive interventions (embolization, microsurgery, radiosurgery, or combination) at Cleveland Clinic.

Methods

An IRB approved retrospective analysis was performed on 673 patients with cerebral AVMs who were treated at the Cleveland Clinic between 2007 and 2014. Of the 673 patients, 105 were unruptured, ARUBA-eligible and were included in the study. Mean follow-up period was 56 months (range 4-136 months). Primary outcome measure is stroke or death. Fisher's exact test and Pearson's Chi-Squared test were used for patient baseline characteristics comparison.

Results

Of the 105 ARUBA-eligible patients, 14 (13.3%) were treated by microsurgery alone, 28 (27%) by embolization plus microsurgery, 51 (49%) with Gamma Knife Radiosurgery alone, 7 (7%) by embolization plus Gamma Knife, and 5 (5%) by a combination of microsurgery and Gamma Knife. A total of 8 (7.6%) patients had a stroke or died. Of the 44 patients that had microsurgery as the final intervention, 5 (11.4%) patients had a stroke or died. Of the 61 patients that had Gamma Knife as the final intervention, 3 (4.9%) patients had a stroke or died.

Figure 1

Characteristic	Treatment (n = 105)	GKS (n = 59)	Microsurgery (n = 47)	p Value
Sex				
female	62 (59)	39 (64)	23 (52)	0.31[a]
Male	43 (41)	22 (36)	21 (48)	
Mean age (yrs)	43 ± 1.3	45 ± 5.8	39 ± 5.9	**0.03**[t]
Right handed	85 (81)	52 (85)	33 (75)	0.21
Risk factors				
Hypertension	24 (23)	21 (34)	3 (7)	**>0.001**[a]
Smoker	40 (38)	23 (38)	17 (38)	1[a]
Ex-smoker	14 (13)	7 (11)	7 (23)	1[a]
Clinical presentation				
Seizure	43 (41)	20 (33)	23 (72)	0.07[a]
Headache	48 (46)	34 (56)	14 (44)	**0.02**[a]
Focal neurological deficits	56 (53)	28 (46)	28 (64)	0.08[a]
Location				**0.001**[c]
Cortical	71 (68)	41 (67)	31 (70)	
Deep	17 (16)	15 (25)	2 (5)	
Cerebellar	14 (13)	3 (5)	11 (25)	
Brainstem	2 (2)	2 (3)	0	
Eloquence				0.2[a]
No	31 (30)	15 (25)	16 (36)	
Yes	75 (71)	46 (75)	28 (64)	
Deep venous drainage				**0.025**[a]
No	65 (62)	32 (52)	33 (75)	
Yes	40 (38)	29 (48)	11 (25)	
Size				0.67[c]
<3cm	55 (52)	34 (56)	21 (48)	
3-6cm	48 (46)	26 (43)	22 (50)	
>6cm	2 (2)	1 (2)	1 (2)	
Mean size (cm)	3.0 ± 0.1	2.9 ± 0.2	3.2 ± 0.3	0.23[t]
Spetzler-Martin grade				0.63[c]
1	14 (13)	6 (10)	8 (18)	
2	31 (30)	18 (30)	13 (30)	
3	35 (33)	21 (34)	14 (32)	
4	23 (22)	15 (25)	8 (18)	
5	1 (1)	1 (2)	0	

a = Fisher Exact test, c = Pearson's Chi-Square test, t = unpaired two tailed t-test

ARUBA-eligible patient characteristics

Figure 2

Treatment	No. of Patients (%)
Resection alone	14 (13)
Resection w/ pre-op embolization	28 (27)
Radiosurgery alone	51 (49)
Radiosurgery with pre-op embolization	7 (7)
Embolization alone	0 (0)
Combination	5 (5)

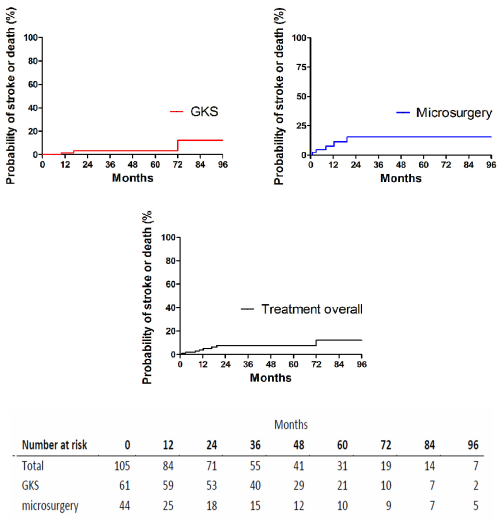
Treatment modality of the 105 ARUBA-eligible patients

Figure 3

Outcome	Microsurgery (n = 44)	GKS (n = 61)	Overall (n = 105)
Stroke	4 (9.1%)	2 (3.3%)	6 (5.7%)
Death	2 (4.5%)	2 (3.3%)	4 (3.8%)
Stroke or death	5 (11.4%)	3 (4.9%)	8 (7.6%)

Proportion of patients who suffered a stroke or death

Figure 4



Kaplan-Meier survival plot for ARUBA-eligible patients

Learning Objectives

1) recognize the different management and treatments for unruptured cerebral AVM.
2) the risk of stroke or death associated with the different treatments.

Conclusions

We report a 7.6% stroke or death rate in our ARUBA-eligible patient population after invasive intervention, which is better than the natural history data reported in the ARUBA trial. Whether microsurgery, radiosurgery, or combination intervention is superior to medical management for unruptured cerebral AVMs requires further investigation.

References

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