

## Introduction

Obstructive sleep apnea (OSA) is associated with progression abdominal aortic aneurysms. However, role of OSA in progression and outcome of treatment in intracranial aneurysm is unknown. We have investigated the role of OSA in progression and outcome of treatment in intracranial aneurysm

## Methods

Patient and aneurysm characteristics and treatment outcomes of patients treated from 2010 through 2015 were analyzed. Association of OSA and outcome of treatment were determined by regression analysis

Table 1: Patients' demographics

Variables	OSA	Non-OSA	P value (OR, CI 95%) (OSA vs. Non-OSA)
Total Cases	12 (4%)	271 (96%)	
Age			
Median	59	58	0.75
Range	42-72	17-84	
Gender			
Male	4 (33%)	69 (25.5%)	0.35 (1.3, 0.72-2.71)
Female	8 (67%)	202 (74.5%)	
Ethnicity			
Caucasians	6 (50%)	164 (60.5%)	0.25 (0.66, 0.37-1.21)
African Americans	6 (50%)	107(39.5%)	
Comorbidities			
HTN	10 (83.3%)	191 (70.5%)	<b>0.04 (2.1, 0.57-1.88)</b>
Smoking	6 (50%)	134 (49%)	<b>0.9 (1.0, 0.57-1.88)</b>
Obesity	8 (67%)	99 (33%)	<b>&lt;0.0001 (4.1, 2.2-7.76)</b>
Hyperlipidemia	4 (33%)	40 (14%)	<b>0.002 (3.1, 1.43-6.60)</b>
Drug abuse	4 (33%)	27 (10%)	<b>0.0001 (4.4, 1.95-10.74)</b>
CAD	5 (41%)	33 (12%)	<b>&lt;0.0001 (5.2, 3.7-11.49)</b>
CVA	4 (33%)	55 (20%)	<b>0.03 (1.9, 1.1-3.97)</b>
DM	3 (25%)	34 (12.5%)	<b>0.04 (2.2, 1.01-5.06)</b>
COPD	3 (25%)	23 (9.7%)	<b>0.008 (2.9, 1.28-7.42)</b>

Table 1: Patients' demographics

Variables	OSA	Non-OSA	P value (OR, CI 95%) (OSA vs. Non-OSA)
Total Cases	12 (4%)	271 (96%)	
Age			
Median	59	58	0.75
Range	42-72	17-84	
Gender			
Male	4 (33%)	69 (25.5%)	0.35 (1.3, 0.72-2.71)
Female	8 (67%)	202 (74.5%)	
Ethnicity			
Caucasians	6 (50%)	164 (60.5%)	0.25 (0.66, 0.37-1.21)
African Americans	6 (50%)	107(39.5%)	
Comorbidities			
HTN	10 (83.3%)	191 (70.5%)	<b>0.04 (2.1, 0.57-1.88)</b>
Smoking	6 (50%)	134 (49%)	<b>0.9 (1.0, 0.57-1.88)</b>
Obesity	8 (67%)	99 (33%)	<b>&lt;0.0001 (4.1, 2.2-7.76)</b>
Hyperlipidemia	4 (33%)	40 (14%)	<b>0.002 (3.1, 1.43-6.60)</b>
Drug abuse	4 (33%)	27 (10%)	<b>0.0001 (4.4, 1.95-10.74)</b>
CAD	5 (41%)	33 (12%)	<b>&lt;0.0001 (5.2, 3.7-11.49)</b>
CVA	4 (33%)	55 (20%)	<b>0.03 (1.9, 1.1-3.97)</b>
DM	3 (25%)	34 (12.5%)	<b>0.04 (2.2, 1.01-5.06)</b>
COPD	3 (25%)	23 (9.7%)	<b>0.008 (2.9, 1.28-7.42)</b>

Table 2: Aneurysms' characteristics

Variables	OSA	Non-OSA	P value (OR, CI 95%) (OSA vs. Non-OSA)
Location of aneurysms			
Anterior circulation	11 (92%)	235 (87%)	0.35 (1.7, 0.67-5.0)
Posterior Circulation	1 (8%)	36 (13%)	
Number of aneurysms (multiple)	3 (25%)	81 (30%)	0.52 (0.77, 0.39-1.51)
Size of aneurysm (mean, mm)	10.68	7.37	0.08
Wide neck aneurysms (>4mm)			
Yes	8 (67%)	96 (35%)	<b>&lt;0.0001 (3.7, 2.01-7.07)</b>
No	4 (33%)	175 (65%)	
Ruptured	8 (67%)	128 (47%)	<b>0.006 (1.2, 1.24-4.23)</b>
Hunt and Hess grade			
Grade IV and V	4 (33%)	26 (9.5%)	<b>0.0001 (4.4, 1.95-10.74)</b>
Treatment			
Clipping	5 (42%)	115 (42%)	
Coiling	7 (58%)	138 (51%)	0.39 (1.3, 0.73-2.40)
Observed	0 (0%)	18 (7%)	

## Results

Among total 283 patients, 12 (4%) patients had OSA. One hundred and twenty patients (42.4%) underwent surgical clipping, 145 patients (51.2%) were undergone endovascular coiling and 18 (6.4%) were observed. Angiographically, patients with OSA (22%) had comparatively higher number of residual aneurysms than patient without OSA (14%). Vasospasm after initial treatment was significantly higher in OSA (25%) group compared to without OSA (8%) group (p=0.004). The mean MRS score was 2 and 1.4 in OSA and without OSA groups, respectively. On regression analysis, patients without OSA (p=0.03), non-smoker (p=0.02) and coiling (p=0.02) were identified as predictors of better outcome. African Americans (0.005), with OSA (p=0.049) and ruptured aneurysms (p<0.001) had significantly higher number of vasospasms.

## Conclusions

Additional care including treatment of vasospasm and re-treatment of residual aneurysms should be taken in the intracranial aneurysm patients associated with OSA. Simultaneous treatment of OSA may be beneficial for these patients.

Table 3: Follow-up results

Variables	OSA	Non-OSA	P value (OR, CI 95%) (OSA vs. Non-OSA)
Follow-up time (mean, months)	29 (6-66)	31 (6-131)	
MRS Scale (median)	2	1.4	<b>0.01</b>
Good (MRS 0-2)	9 (75%)	234 (86%)	
Poor (MRS 3-6)	3 (25%)	37 (14%)	<b>0.07 (2.0, 0.94-4.57)</b>
Radiological outcome			
Complete occlusion	9 (75%)	234 (86%)	
Residual	3 (25%)	37 (14%)	<b>0.07 (2.0, 0.94-4.57)</b>
Vasospasm			
Yes	3 (25%)	23 (8%)	<b>0.005 (3.4, 1.37-9.26)</b>
VP shunt	0 (0%)	23 (8.5%)	
LOS (mean)	9.7 (1-30)	7.8 (1-43)	<b>0.40</b>

Univariate analysis

Variables	OR (95% CI)	P value
Predictor for poor outcome		
Gender (Male)	1.0 (0.48-2.27)	0.90
HTN (yes)	2.5 (1.04-6.40)	<b>0.04</b>
DM (yes)	2.2 (0.96-5.16)	0.06
CAD (yes)	2.6 (1.13-5.79)	<b>0.02</b>
CVA (yes)	1.9 (0.91-4.10)	0.08
Smoking (yes)	2.7 (1.33-5.61)	<b>0.006</b>
OSA (yes)	1.9 (1.04-3.90)	<b>0.03</b>
Coiling (yes)	2.5 (1.12-5.75)	<b>0.02</b>
Predictor for poor vasospasm		
African Americans	3.1 (1.35-7.37)	<b>0.005</b>
Ruptured aneurysm	15.5 (3.59-67.13)	<b>&lt;0.001</b>
OSA	3.5 (1.01-14.21)	<b>0.049</b>