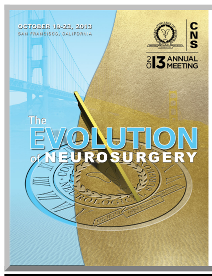

The Utility and Limitations of Intraoperative Near Infrared Indocyanine Green Videoangiography in Aneurysm Surgery

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Introduction

The goal of surgery is to achieve complete exclusion of the aneurysm from the circulation and preservation of parent and perforating vessels. However, the incidence of residual aneurysms and parent artery occlusion on perioperative angiography varies from 1.8% to 3.6% and 1.6% to 21 % respectively in the literature.2-12 Past studies documented that the use of intraoperative angiography during aneurysm surgery significantly altered the surgical procedure in 7-34% of cases. The aim of our study was to analyze the clip repositioning rate and the correlation between ICGA and post -operative angiography for completeness of aneurysm occlusion and parent vessel compromise.

Methods

All patients with intracranial aneurysms treated by a single surgeon (BG) from 2008-2013 and who underwent ICGA during surgery were included in the study. Operative summaries, angiograms, and postoperative and ICG videoangiography videos were reviewed. Clip repositioning rate and correlation of ICGA and post-operative angiography for completeness of aneurysm occlusion and parent vessel compromise were analyzed.

Discordance between ICG videoangiography and IA was defined as ICG videoangiography demonstrating aneurysm obliteration and normal vessel flow, but postoperative angiogram showing either an aneurysmal remnant and/or vessel occlusion requiring clip repositioning.

Results

During the study period, 112 patients with 126 intracranial aneurysms underwent surgical clipping. Of the 126 aneurysms, 120 were located in anterior circulation and the rest (n=6) along posterior circulation. Two-thirds of the aneurysms (66%) were ruptured. In 10 patients (8%), ICGA resulted in clip reposition during surgery.

Causes of clip repositioning included residual aneurysmal remnant in 7 patients, parent artery compromise in 2 patients and branch vessel compromise in one patient. In all these patients, postoperative angiography showed optimal clip position. Discordance between ICGA and postoperative angiography was observed in five patients (4%). There were two patients each with Acom and ophthalmic internal carotid artery aneurysms (22.2% and 5.9% respectively) and one patient (3.3%) with MCA bifurcation aneurysm. In one of the two patients with Acom aneurysms, the ICGA showed complete obliteration of the aneurysm, however, postoperative angiography showed a neck remnant.

In the other patient, a perforator vessel was caught in the clip blades which was noted only on postoperative angiography. In the two patients with ophthalmic ICA aneurysms, residual neck was noted along the anterior wall of the aneurysm (Figure). Mild branch vessel compromise was noted in a patient with a MCA bifurcation aneurysm on postoperative angiography, which was not detected on ICGA. There was no significant difference of ICGA-postoperative angiography discordance between ruptured and unruptured aneurysms (P= 0.56). On multivariate analysis, patient age, gender, aneurysm size, and rupture status did not reach significance. Aneurysm location for ophthalmic ICA location was significant. In univariate analysis, ophthalmic ICA aneurysms were more likely to have discordance when compared to all other aneurysms (P = 0.04; OR = 10.8; CI 1.5 - 75.94).

Case Illustration

49 year old lady with multiple aneurysms. the images show discordance between ICGA and postoperative angiography for ophthalmic ICA aneurysm

Conclusions

These results indicate that although ICGA is an excellent technique for assessing aneurysm obliteration. Its results should be considered with caution in patients with ophthalmic segment internal carotid aneurysms, where intraoperative angiography may be more accurate

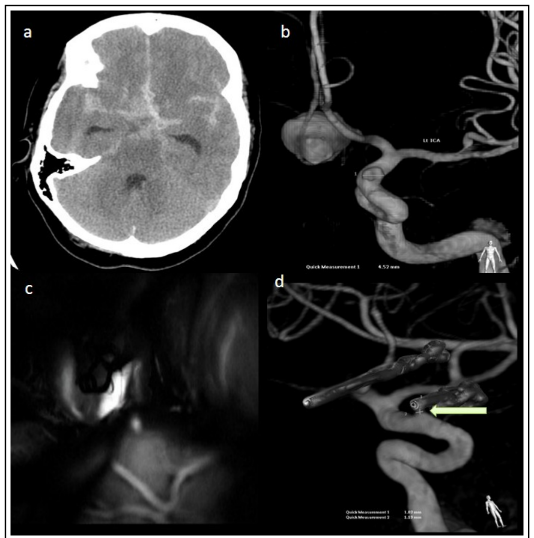

Table 1: Comparison of ICGA-postoperative angiography concordance in our study.

Variable	Discordance n (%)	Non discordance n (%)	P value
No. of patients	5 (4)	107 (96)	
Age (yrs)	52.5	53.5	
Gender			0.83
Male	1 (3.4)	28 (96.7)	
Female	4 (4.8)	79 (95.2)	
Aneurysm location			
ACom#	2 (5.9)	32 (94.1)	0.53
Ophthalmic	**2 (22.2)**	**7 (77.8)**	**0.04***
MCA bifurcation	1 (3.3)	30 (96.7)	0.88
PCom#	0 (0)	28 (100)	0.28
ICA # bifurcation	0 (0)	18 (100)	0.46
Basilar bifurcation	0 (0)	4 (100)	0.85
PICA#	0 (0)	2 (100)	0.92
Aneurysm size			
< 7mm	2 (16.6)	10 (93.4)	0.08
7-12 mm	2 (4)	48 (96)	0.98
13-24 mm	1 (1.7)	56 (98.3)	0.29
> 24 mm	0 (0)	7 (100)	0.75
Rupture status			
Unruptured	1 (2.3)	42 (97.7)	0.56
Ruptured	4 (4.8)	79 (95.2)	

Reference

Raabe A, Nakaji P, Beck J, et al. Prospective evaluation of surgical microscope-integrated intraoperative near-infrared indocyanine green videoangiography during aneurysm surgery. Journal of neurosurgery. Dec 2005;103(6):982-989.