Does preoperative measurement of cerebral blood flow with acetazolamide challenge in addition to preoperative measurement of cerebral blood flow at the resting state increase the predictive accuracy of development of cerebral hyperperfusion after carotid endarterectomy? – Results from 500 cases with brain perfusion single-photon emission computed tomography study –

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Abstract

The purpose of the present study was to determine whether preoperative measurement of cerebral blood flow (CBF) with acetazolamide in addition to preoperative measurement of CBF at the resting state increases the predictive accuracy of development of cerebral hyperperfusion after carotid endarterectomy (CEA). CBF at the resting state and cerebrovascular reactivity (CVR) to acetazolamide were quantitatively assessed using the N-isopropyl-p-[^{123}I]-iodoampheramine (IMP)-autoradiography method with single-photon emission computed tomography (SPECT) before CEA in 500 patients with ipsilateral internal carotid artery stenosis(≧70%). CBF measurement using ^{123}I-IMP SPECT was also performed immediately and at 3 days after CEA. A region of interest was automatically placed in the middle cerebral artery territory in the affected cerebral hemisphere using a three-dimensional stereotactic region-of-interest template. Preoperative decreases in CBF at the resting state (95% CIs, 0.855 to 0.967; P=0.0023) and CVR to acetazolamide (95% CIs, 0.844 to 0.912; P<0.0001) were significant independent predictors of post-CEA hyperperfusion. The area under the receiver operating characteristic curve for CVR to acetazolamide than for CBF at the resting state (difference between areas, 0.173; P<0.0001). Sensitivity, specificity, and positive- and negative-predictive values for the prediction of the development of post-CEA hyperperfusion were significantly greater for CVR to acetazolamide than for CBF at the resting state (P<0.05, respectively). The present study demonstrated that preoperative measurement of CBF with acetazolamide in addition to preoperative measurement of CBF at the resting state increases the predictive accuracy of the development of post-CEA hyperperfusion.

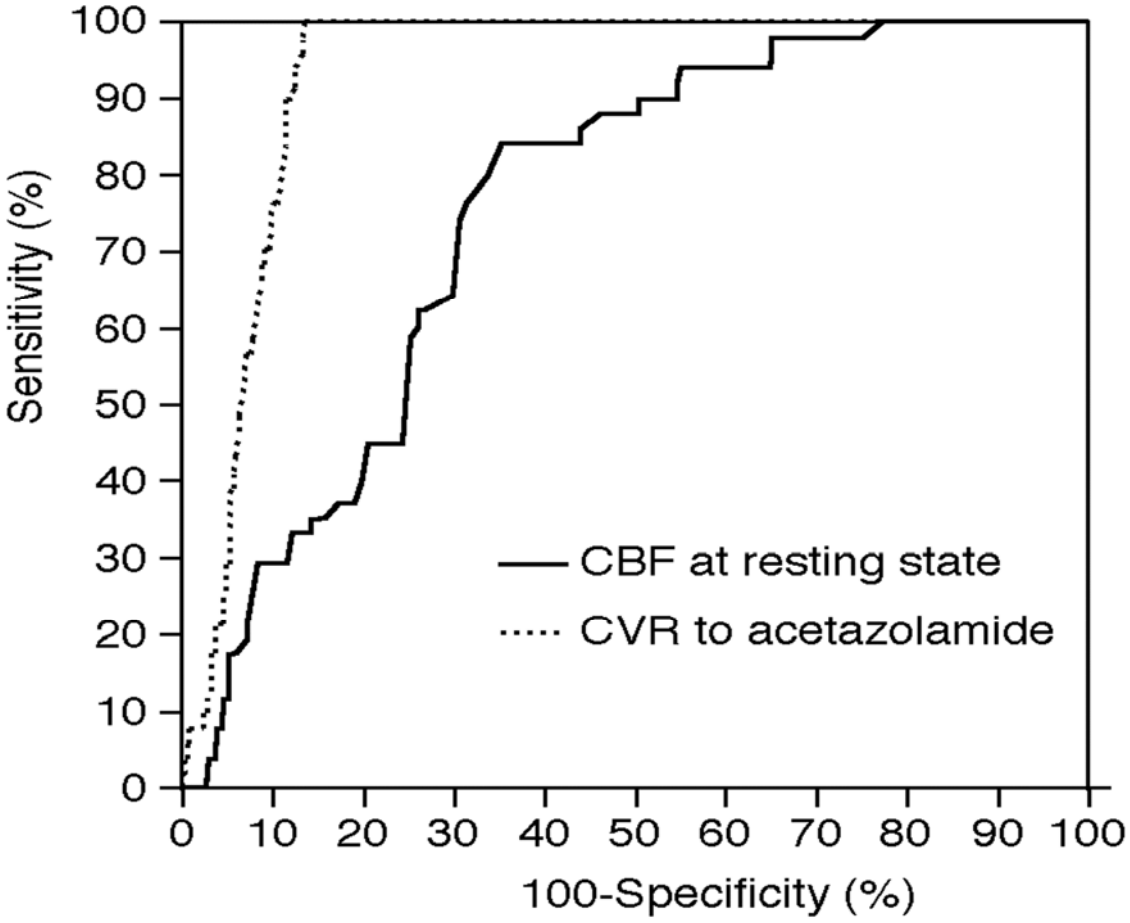
Table 1 Risk factors for the development of postoperative cerebral hyperperfusion

Risk factors	Postoperative hyperperfusion		P value
	Yes (n = 51)	No (n = 449)	
Age (years) (mean ± SD)	71.3 ± 5.8	68.7 ± 6.8	0.0128
Male gender	45 (88%)	413 (92%)	0.4195
Hypertension	46 (90%)	378 (84%)	0.3087
Diabetes mellitus	24 (47%)	158 (35%)	0.1238
Dyslipidemia	23 (45%)	224 (50%)	0.5565
Symptomatic lesion	39 (76%)	275 (61%)	0.0332
Degree of ICA stenosis (%) (mean ± SD)	91.3 ± 5.9	84.6 ± 8.8	< 0.0001
Bilateral lesion	14 (27%)	88 (20%)	0.2001
Duration of ICA clamping (min) (mean ± SD)	36.8 ± 6.2	37.2 ± 5.3	0.6938
Use of intraluminal shunt	1 (2.0%)	2 (0.4%)	0.8776
CBF at resting state (ml/100 g/min)	24.3 ± 4.5	30.6 ± 7.3	< 0.0001
CVR to acetazolamide (%)	9.2 ± 6.6	33.4 ± 15.4	< 0.0001

Table 2

Sensitivity, specificity, and positive- and negative-predictive values for CBF at resting state and CVR to acetazolamide for the prediction of the development of postoperative hyperperfusion.

	CBF at resting state	CVR to acetazolamide	P value
Sensitivity (95% CIs)	84.3% (71.4 to 93.0%)	100.0% (93.1 to 100.0%)	<0.05
Specificity (95% CIs)	64.6% (60.6 to 69.0%)	86.4% (82.9 to 89.4%)	<0.05
Positive-predictive value (95% CIs)	21.3% (15.9 to 27.6%)	45.5% (36.1 to 55.2%)	<0.05
Negative-predictive value (95% CIs)	97.3% (94.8 to 98.8%)	100.0% (99.1 to 100.0%)	<0.05



Receiver operating characteristic curves used to compare accuracy among cerebral blood flow (CBF) at the resting state and cerebrovascular reactivity (CVR) to acetazolamide for the prediction of the development of cerebral hyperperfusion immediately after carotid endarterectomy.