

123I-iodoamphetamine single-photon emission computed tomography

Cerebrovascular reserve (CVR) is an important indicator for the management of and therapy for **Cerebrovascular Occlusive Disease** (CAOD). Vasodilatory function is measured using the standard **IMP-ARG method**. The IMP autoradiography (IMP-ARG) method employed here uses a standardized input function, which was derived from 12 patients between 31 and 71 years of age. Because the population of elderly patients continues to increase in Japan, additional therapies are required to assess CVR in elderly patients with chronic cardiopulmonary disease or a history of smoking, in particular. Despite its popularity, alternatives to the IMP-ARG method are necessary.

Mizumura et al., proposed the microsphere (MS) method without an input function.

Using this method and the IMP-ARG method, they measured the CVRs of 18 CAOD patients.

The CVRs derived with these two methods were significantly and linearly correlated ($r = 0.89$, $p < 0.01$). CVRs categorized by severity were also found to correspond between the two methods ($\kappa = 0.87$).

Thus, the method proposed here may serve as a supplemental to and be compatible with the IMP-ARG method for the assessment of CVR. Furthermore, the two methods, when used in conjunction, may result in less error than either would alone ¹⁾.

Unclassified

1: Yanagihara W, Chida K, Kobayashi M, Kubo Y, Yoshida K, Terasaki K, Ogasawara K. Impact of cerebral blood flow changes due to arterial bypass surgery on cognitive function in adult patients with symptomatic ischemic moyamoya disease. *J Neurosurg.* 2018 Dec 1:1-9. doi: 10.3171/2018.7.JNS18149. [Epub ahead of print] PubMed PMID: 30554180.

2: Kawano T, Ohmori Y, Kaku Y, Muta D, Uekawa K, Nakagawa T, Amadatsu T, Kasamo D, Shiraishi S, Kitajima M, Kuratsu J. Prolonged Mean Transit Time Detected by Dynamic Susceptibility Contrast Magnetic Resonance Imaging Predicts Cerebrovascular Reserve Impairment in Patients with Moyamoya Disease. *Cerebrovasc Dis.* 2016;42(1-2):131-8. doi: 10.1159/000445696. Epub 2016 Apr 19. PubMed PMID: 27088711.

3: Fujioka Y, Hata N, Sangatsuda Y, Inoue D, Haga S, Nagata S. A case of metastatic brain tumor in the perfusion territory of superficial temporal artery-middle cerebral artery anastomosis. *Surg Neurol Int.* 2015 Nov 25;6(Suppl 25):S637-9. doi: 10.4103/2152-7806.170468. eCollection 2015. PubMed PMID: 26682089; PubMed Central PMCID: PMC4672580.

4: Yoshida K, Ogasawara K, Saura H, Saito H, Kobayashi M, Yoshida K, Terasaki K, Fujiwara S, Ogawa A. Post-carotid endarterectomy changes in cerebral glucose metabolism on (18)F-fluorodeoxyglucose positron emission tomography associated with postoperative improvement or impairment in cognitive function. *J Neurosurg.* 2015 Dec;123(6):1546-54. doi: 10.3171/2014.12.JNS142339. Epub 2015 Jul 31. PubMed PMID: 26230467.

5: Onishi H, Hatazawa J, Nakagawara J, Ito K, Ha-Kawa SK, Masuda Y, Sugibayashi K, Takahashi M, Kikuchi K, Katsuta N. Impact of injected dose and acquisition time on a normal database by use of 3D-SSP in SPECT images: quantitative simulation studies. *Radiol Phys Technol.* 2015 Jul;8(2):224-31. doi:

10.1007/s12194-015-0311-8. Epub 2015 Mar 11. PubMed PMID: 25758210.

6: Wada H, Saito M, Kamada K. Evaluation of changes of intracranial blood flow after carotid artery stenting using digital subtraction angiography flow assessment. *World J Radiol.* 2015 Feb 28;7(2):45-51. doi: 10.4329/wjr.v7.i2.45. PubMed PMID: 25729486; PubMed Central PMCID: PMC4326733.

7: Yamada S, Kobayashi M, Watanabe Y, Miyake H, Oshima M. Quantitative measurement of blood flow volume in the major intracranial arteries by using 123i-iodoamphetamine SPECT. *Clin Nucl Med.* 2014 Oct;39(10):868-73. doi: 10.1097/RLU.0000000000000555. PubMed PMID: 25140561.

8: Kimiwada T, Hayashi T, Shirane R, Tominaga T. 123I-IMP-SPECT in a patient with cerebral proliferative angiopathy: a case report. *J Stroke Cerebrovasc Dis.* 2013 Nov;22(8):1432-5. doi: 10.1016/j.jstrokecerebrovasdis.2013.05.038. Epub 2013 Jul 4. PubMed PMID: 23830953.

9: Yoneda H, Shirao S, Koizumi H, Oka F, Ishihara H, Ichiro K, Kitahara T, Iida H, Suzuki M. Reproducibility of cerebral blood flow assessment using a quantitative SPECT reconstruction program and split-dose 123I-iodoamphetamine in institutions with different γ -cameras and collimators. *J Cereb Blood Flow Metab.* 2012 Sep;32(9):1757-64. doi: 10.1038/jcbfm.2012.67. Epub 2012 May 23. PubMed PMID: 22617648; PubMed Central PMCID: PMC3434636.

10: Fujimura M, Kaneta T, Shimizu H, Tominaga T. Symptomatic hyperperfusion after superficial temporal artery-middle cerebral artery anastomosis in a child with moyamoya disease. *Childs Nerv Syst.* 2007 Oct;23(10):1195-8. Epub 2007 May 8. PubMed PMID: 17486352.

11: Sagiuchi T, Oka H, Utsuki S, Sato K, Kobayashi I, Asano Y, Ishii K, Fujii K. Increased accumulations of N-isopropyl-p-[123I]-iodoamphetamine related to tumefactive multiple sclerosis. *Ann Nucl Med.* 2005 Oct;19(7):603-6. PubMed PMID: 16363626.

12: Fukino K, Terao T, Kojima T, Adachi K, Teramoto A. Chronic subdural hematoma following dural metastasis of gastric cancer: measurement of pre- and postoperative cerebral blood flow with N-isopropyl-p-[123I]iodoamphetamine-case report. *Neurol Med Chir (Tokyo).* 2004 Dec;44(12):646-9. PubMed PMID: 15684596.

13: Saito N, Nakagawara J, Nakamura H, Teramoto A. Assessment of cerebral hemodynamics in childhood moyamoya disease using a quantitative and a semiquantitative IMP-SPECT study. *Ann Nucl Med.* 2004 Jun;18(4):323-31. PubMed PMID: 15359926.

14: Yamashita Y, Kumabe T, Shimizu H, Ezura M, Tominaga T. Spontaneous regression of a primary cerebral tumor following vasospasm caused by subarachnoid hemorrhage due to rupture of an intracranial aneurysm-case report. *Neurol Med Chir (Tokyo).* 2004 Apr;44(4):187-90. PubMed PMID: 15185757.

15: Shinoda J, Yano H, Murase S, Yoshimura S, Sakai N, Asano T. High 123I-IMP retention on SPECT image in primary central nervous system lymphoma. *J Neurooncol.* 2003 Feb;61(3):261-5. PubMed PMID: 12675320.

16: Tominaga T, Shamoto H, Shimizu H, Watanabe M, Yoshimoto T. Selective loss of Purkinje cells in transverse and sigmoid dural arteriovenous fistulas. Report of two cases. *J Neurosurg.* 2003 Mar;98(3):617-20. PubMed PMID: 12650437.

17: Ogasawara K, Ogawa A, Terasaki K, Shimizu H, Tominaga T, Yoshimoto T. Use of cerebrovascular

- reactivity in patients with symptomatic major cerebral artery occlusion to predict 5-year outcome: comparison of xenon-133 and iodine-123-IMP single-photon emission computed tomography. *J Cereb Blood Flow Metab.* 2002 Sep;22(9):1142-8. PubMed PMID: 12218420.
- 18: Akiyama Y, Moritake K, Yamasaki T, Kimura Y, Kaneko A, Yamamoto Y, Miyazaki T, Daisu M. The diagnostic value of 123I-IMP SPECT in non-Hodgkin's lymphoma of the central nervous system. *J Nucl Med.* 2000 Nov;41(11):1777-83. PubMed PMID: 11079483.
- 19: Inoue N, Yoshioka S, Kobayashi O, Ichimura H, Yoshizato K, Yamaguchi H, Yamauchi H, Ushio Y. Cerebral function after aortic surgery using retrograde cerebral perfusion: report of three cases. *Ann Thorac Cardiovasc Surg.* 2000 Feb;6(1):46-50. PubMed PMID: 10748359.
- 20: Ogura T, Takikawa S, Saito H, Nakazawa M, Shidahara M, Iida H. [Validation and optimization of the use of standardized arterial input function in N-isopropyl-p-[123I]iodoamphetamine cerebral blood flow SPECT]. *Kaku Igaku.* 1999 Oct;36(8):879-90. Japanese. PubMed PMID: 10586549.
- 21: Makino K, Masuda Y, Gotoh S. [Measurement of regional cerebral blood flow using one-point arterial blood sampling and microsphere model with 123I-IMP: correction of one-point arterial sampling count by whole brain count ratio]. *Kaku Igaku.* 1998 Jul;35(6):405-12. Japanese. PubMed PMID: 9753919.
- 22: Kawaguchi T, Fujita S, Hosoda K, Shibata Y, Komatsu H, Tamaki N. [Usefulness of multiple burr-hole operation for child Moyamoya disease]. *No Shinkei Geka.* 1998 Mar;26(3):217-24. Japanese. PubMed PMID: 9558653.
- 23: Shiina G, Onuma T, Kameyama M, Shimosegawa Y, Ishii K, Shirane R, Yoshimoto T. Sequential assessment of cerebral blood flow in diffuse brain injury by 123I-iodoamphetamine single-photon emission CT. *AJNR Am J Neuroradiol.* 1998 Feb;19(2):297-302. PubMed PMID: 9504482.
- 24: Sugou N, Shibata I, Nemoto A, Nemoto M, Ohishi H, Kuroki T, Seiki Y, Terao H, Takahashi H, Takano M, Takahashi M. [High uptake of N-isopropyl-p-[123I]iodoamphetamine (123I-IMP) demonstrated by dynamic SPECT in some cases of glioma]. *Kaku Igaku.* 1996 Jul;33(7):695-704. Japanese. PubMed PMID: 8803437.
- 25: Makino K, Masuda Y, Gotoh S. [Comparison of cerebral vasoreactivity to acetazolamide in normal volunteer among 123I-IMP, 99mTc-ECD and 99mTc-HMPAO]. *Kaku Igaku.* 1996 May;33(5):551-5. Japanese. PubMed PMID: 8699624.
- 26: Mori K, Maeda M, Asegawa S, Masuda Y, Takeoka K. A new technique for quantitative imaging of cerebrovascular reserve capacity using a double injection method with N-isopropyl-p-[123I]iodoamphetamine. *Neuroimage.* 1996 Apr;3(2):89-96. PubMed PMID: 9345479.
- 27: Kawaguchi T, Fujita S, Hosoda K, Shose Y, Hamano S, Iwakura M, Tamaki N. Multiple burr-hole operation for adult moyamoya disease. *J Neurosurg.* 1996 Mar;84(3):468-76. PubMed PMID: 8609560.
- 28: Kurata A, Miyasaka Y, Yoshida T, Kunii M, Yada K, Kan S. Venous ischemia caused by dural arteriovenous malformation. Case report. *J Neurosurg.* 1994 Mar;80(3):552-5. PubMed PMID: 8113870.
- 29: Nakagawara J, Nakamura J, Takeda R, Okumura T, Seki T, Hayase K, Satoh K, Suematsu K. Assessment of postischemic reperfusion and diamox activation test in stroke using 99mTc-ECD SPECT. *J Cereb Blood Flow Metab.* 1994 Jan;14 Suppl 1:S49-57. PubMed PMID: 8263072.
- 30: Mori K, Nakajima K, Maeda M. Theoretical and experimental assessment of the kinetic properties

of N-isopropyl-p-[123I]iodoamphetamine in the human brain. *Neurol Med Chir (Tokyo)*. 1993 Dec;33(12):809-14. PubMed PMID: 7512225.

31: Araki Y, Imao Y, Andoh T, Sakai N, Yamada H. [The evaluation of tumor blood flow measured by single photon emission CT]. *No Shinkei Geka*. 1993 Mar;21(3):227-33. Japanese. PubMed PMID: 8487926.

32: Kimura T, Shinoda J, Funakoshi T. Prediction of cerebral infarction due to vasospasm following aneurysmal subarachnoid haemorrhage using acetazolamide-activated 123I-IMP SPECT. *Acta Neurochir (Wien)*. 1993;123(3-4):125-8. PubMed PMID: 8237489.

33: Takano S, Saito M, Murata K, Ohbu M, Miyasaka Y, Yada K, Kan S, Takagi H. [Primary intracranial melanoma: a case report]. *No Shinkei Geka*. 1992 Nov;20(11):1211-5. Japanese. PubMed PMID: 1448198.

34: Munaka M, Iida H. [New quantification of regional cerebral blood flow measurements by 123I-IMP SPECT with the rotating gamma camera-theory and validation of the look-up table method]. *Kaku Igaku*. 1992 Mar;29(3):385-9. Japanese. PubMed PMID: 1583809.

35: Hirai O, Yamakawa H, Nishikawa M, Watanabe S, Kinoshita Y, Uno A, Handa H. [Ventricular dilation during the treatment of subdural hygromas]. *Neurol Med Chir (Tokyo)*. 1991 Dec;31(13):943-7. Japanese. PubMed PMID: 1726257.

36: Kamiya K, Yamashita N, Nagai H, Mizawa I. Investigation of normal pressure hydrocephalus by 123I-IMP SPECT. *Neurol Med Chir (Tokyo)*. 1991 Aug;31(8):503-7. PubMed PMID: 1722878.

37: Shinoda J, Kimura T, Funakoshi T, Araki Y, Imao Y. Acetazolamide reactivity on cerebral blood flow in patients with subarachnoid haemorrhage. *Acta Neurochir (Wien)*. 1991;109(3-4):102-8. PubMed PMID: 1858527.

38: Nagata K, Asano T. Functional image of dynamic computed tomography for the evaluation of cerebral hemodynamics. *Stroke*. 1990 Jun;21(6):882-9. PubMed PMID: 2349591.

39: Abe M, Kanaoka N, Nonomura K, Kawase T, Sano H, Kanno T, Toyama H. [Crossed cerebellar diaschisis in hydrocephalus-a case report]. *No To Shinkei*. 1989 Nov;41(11):1085-90. Japanese. PubMed PMID: 2620009.

40: Nakano S, Kinoshita K, Jinnouchi S, Hoshi H, Watanabe K. Dynamic SPECT with technetium-99m HM-PAO in meningiomas-a comparison with iodine-123 IMP. *J Nucl Med*. 1989 Jun;30(6):1101-5. PubMed PMID: 2786949.

41: Nakano S, Kinoshita K, Jinnouchi S, Hoshi H, Watanabe K. Critical cerebral blood flow thresholds studied by SPECT using xenon-133 and iodine-123 iodoamphetamine. *J Nucl Med*. 1989 Mar;30(3):337-42. PubMed PMID: 2786938.

42: Nakano S, Kinoshita K, Jinnouchi S, Hoshi H, Watanabe K. Comparative study of regional cerebral blood flow images by SPECT using xenon-133, iodine-123 IMP, and technetium-99m HM-PAO. *J Nucl Med*. 1989 Feb;30(2):157-64. PubMed PMID: 2786931.

43: Nakano S, Kinoshita K, Jinnouchi S, Hoshi H, Watanabe K. Dynamic SPECT with iodine-123 IMP in meningiomas. *J Nucl Med*. 1988 Oct;29(10):1627-32. PubMed PMID: 3262724.

44: Ueda T, Kinoshita K, Watanabe K, Hoshi H, Jinnouchi S. Early and delayed single photon emission CT in various cerebral diseases using N-isopropyl-p-(123I)iodoamphetamine. *Neuroradiology*. 1988;30(2):123-31. PubMed PMID: 3260355.

1)

Mizumura S, Iwabuchi S, Fujita S, Harashina J, Kajiyama A, Gomi T. Measurement of cerebral vascular reserves with I-123 IMP SPECT without an arterial input function using the microsphere model and radiopharmaceutical dose calibration. *Ann Nucl Med*. 2019 Apr 13. doi: 10.1007/s12149-019-01336-x. [Epub ahead of print] PubMed PMID: 30982125.

From:

<https://operativeneurosurgery.com/> - **Operative Neurosurgery**

Permanent link:

https://operativeneurosurgery.com/doku.php?id=123i-iodoamphetamine_single-photon_emission_computed_tomography

Last update: **2019/04/15 12:31**

