Unilateral Approach for Bilateral Middle Cerebral Artery Aneurysms Assisted by Preoperative Understanding of Aneurysm Wall Properties: Two-Dimensional Operative Video

Kimura, Hidehito ; Hayashi, Kosuke ; Osaki, Susumu ; Shibano, Ayaka ; Fujita, Yuichi ; Nagashima, Hiroaki ; Tomiyama, Akio ; Sasayama,…

(Citation)
World Neurosurgery,162:42

(Issue Date)
2022-06

(Resource Type)
journal article

(Version)
Accepted Manuscript

(URL)
https://hdl.handle.net/20.500.14094/0100477764

Unilateral approach for bilateral middle cerebral artery aneurysms assisted by preoperative understandings of aneurysm wall properties: 2-dimensional operative video

Hidehito Kimura, M.D., Ph.D.[1]; Kosuke Hayashi, D.Eng.[2]; Susumu Osaki, M.Eng.[2]; Ayaka Shibano, M.D.[1], Yuichi Fujita, M.D., Ph.D.[1]; Hiroaki Nagashima, M.D., Ph.D.[1]; Akio Tomiyama, D.Eng.[2]; Takashi Sasayama, M.D., Ph.D.[1]

[1]Department of Neurosurgery, Kobe University Graduate School of Medicine, Kobe, Japan
[2]Graduate School of Engineering, Kobe University, Kobe, Japan

Key words:
intracranial aneurysm, middle cerebral artery, contralateral approach, unilateral approach, surgical technique, computational fluid dynamic analysis, atherosclerosis

Short title: Contralateral clipping with knowing wall properties

Corresponding author
Hidehito Kimura, M.D. Ph.D.
Department of Neurosurgery, Kobe University Graduate School of Medicine
7-5-1, Kusunoki-cho, Chuo-ku, Kobe, 650-0017, JAPAN
E-mail: hkimura@med.kobe-u.ac.jp

Abstract:

Unruptured middle cerebral artery (MCA) aneurysms often exist bilaterally, and a unilateral approach for bilateral MCA aneurysms has been reported; however, this remains challenging because there is a variety of technical nuances[1], [2], [3], [4]. Wall properties have been reported to be an important issue for this strategy[2], [3]. Atherosclerotic changes in the aneurysm wall can make clipping difficult. We present a case underwent bilateral MCA aneurysms clipping via a unilateral craniotomy assisted by preoperative understandings of the aneurysm wall properties using computational fluid dynamic (CFD) analysis. A 71-year-old woman had bilateral MCA bifurcation aneurysms. The oscillatory shear index (OSI) color map by CFD analysis demonstrated that the contralateral MCA AN did not have a high OSI area in the dome, which means that there was no wall thickening, and the ipsilateral MCA aneurysm had scattered high OSI areas, which were expected to have extreme wall thickening areas[5]. After a pterional craniotomy, the sylvian fissure was widely opened. As expected, the contralateral MCA AN did not have a thick-walled region, enabling simple neck clipping using a straight clip. On the other hand, the ipsilateral MCA aneurysms had thick-walled areas, as predicted, and necessitated a multiple clip application. Postoperatively, the patient was discharged without any neurological deficits. Prediction of aneurysm wall properties using CFD analysis could assist the decision for clippability of intracranial aneurysms, especially for aneurysms approached by narrow and deep surgical fields such as contralateral MCA aneurysms. The patient consented to the procedure and the publication of their images.

Acknowledgments

We thank Mr. Noriyuki Negi for assisting with the radiological data analysis.

Funding

This work was supported by Japan Society for the Promotion of Science KAKENHI Grant Number JP 17K10826.

References:

1. Inci S, Akbay A, Ozgen T. Bilateral middle cerebral artery aneurysms: A comparative study of unilateral and bilateral approaches. *Neurosurg Rev*. 2012;35(4):505-518. doi:10.1007/s10143-012-0392-3
2. Rodríguez-Hernández A, Gabarrós A, Lawton MT. Contralateral Clipping of Middle Cerebral Artery AneurysmsRationale, Indications, and Surgical Technique. *Oper Neurosurg*. 2012;71(suppl_1):ons116-ons124. doi:10.1227/NEU.0B013E31824D8F66
3. Andrade-Barazarte H, Kivelev J, Goehre F, et al. Contralateral Approach to Bilateral Middle Cerebral Artery Aneurysms: Comparative Study, Angiographic Analysis, and Surgical Results. *Neurosurgery*. 2015;77(6):916-925. doi:10.1227/NEU.0000000000000930
4. Cho MJ, Oh CW, Kwon OK, et al. Comparison of Unilateral and Bilateral Craniotomy for the Treatment of Bilateral Middle Cerebral Artery Aneurysms: Anatomic and Clinical Parameters and Surgical Outcomes. *World Neurosurg*. 2017;108:627-635. doi:10.1016/j.wneu.2017.08.175
5. Furukawa K, Ishida F, Tsuji M, et al. Hemodynamic characteristics of hyperplastic remodeling lesions in cerebral aneurysms. *PLoS One*. 2018;13(1). doi:10.1371/journal.pone.0191287