



Regional Mild Hypothermia in Aneurysm Surgery

Mirton N Prandini* and Franz J Onishi

Department of Neurosurgery, Federal University of São Paulo, Brazil

Abstract

The clinical use of hypothermia in the treatment of brain aneurysms remains a topic of great debate between its benefits and possible side effects. Brain protection with mild hypothermia is still under debate since the whole body needs to be cooled. Loco-regional hypothermia may be a valuable option. We present a case in which an anastomosis termino-terminal was performed in a patient who suffered an episode of aneurysm bleeding. Cerebral protection with loco-regional mild hypothermia was able to provide brain protection during 23 min of temporary clipping.

Keywords: Hypothermia; Cerebral aneurysm; Neuroprotection; Complex aneurysm

Introduction

Aneurysms surgery still demands some procedures to minimize the consequences of arterial circulation reduction occurring during the period of temporary clipping. Until now a day's no drug with proven efficiency for cerebral protection in ischemic onset is available. Therefore, hypothermia is still the only tool we can count on in these situations. Although fusiform aneurysms constitute a minority of cases, they need to be treated, mainly after an episode of bleeding. Some possibilities exist for treatment. An endovascular approach is a good option. However, in some cases, the stent protection still has not yet reached the level required for a good result. In these cases, microvascular surgery may be a valuable option. Brain protection with mild hypothermia is still under debate since the whole body needs to be cooled. Loco-regional hypothermia may be a valuable option. We present a case in which an anastomosis termino-terminal was performed in a patient who suffered an episode of aneurysm bleeding. Cerebral protection with loco-regional mild hypothermia was able to provide brain protection during 23 min of temporary clipping. Local-regional mild hypothermia (30°C) demonstrated to be a good tool for parenchymal neuroprotection in cases of temporary reduction of arterial cerebral circulation.

Case Presentation

This 48-year-old woman was admitted to our department after one episode of severe headache and right hemiparesis. The patient has been on treatment for diabetes and hypertension over the last 10 years. Her husband referred that the patient's mother presented the same symptoms and died about 15 years ago. She received the diagnosis of a cerebral hemorrhage.

Neurological examination demonstrated right hemiparesis and some mental confusion. Neck stiffness ++++.

Her arterial blood pressure was 180/110 mmHg and her blood glucose was 380.

Magnetic resonance demonstrated an area of parenchymal hemorrhage and arterial dilation at Sylvian fissure (Figure 1). Cerebral angiography disclosed a fusiform aneurysm in the middle cerebral artery territory (Figure 2).

Some approaches were discussed and an EC-IC bypass was considered. However, a good place for anastomosis was not feasible. We decided to perform a termino-terminal anastomosis carried out under loco-regional mild hypothermia (30°C) two weeks later. Complete anastomosis required temporary clipping of 23 min duration. Loco-regional mild hypothermia is done in order to reduce the parenchymal temperature in the region affected by the provoked ischemia consequent to the temporary clipping. The parenchyma was washed with saline 500 ml at a 10°C temperature and 2 ml of Papaverine hydrochloride to maintain the local temperature around 30°C (Figure 3).

Postoperative angiography demonstrated good circulatory flow (Figure 4).

The patient had a good recovery and was discharged from the hospital two weeks later. After two months, only a slight hemiparesis remained.

OPEN ACCESS

*Correspondence:

Mirton N Prandini, Department of Neurosurgery, Federal University of São Paulo (UNIFESP), Brazil, Tel: 55 (11) 991156830;
E-mail: mnprandini@uol.com.br

Received Date: 19 Mar 2021

Accepted Date: 14 Apr 2021

Published Date: 16 Apr 2021

Citation:

Prandini MN, Onishi FJ. Regional Mild Hypothermia in Aneurysm Surgery. *Ann Clin Surg.* 2021; 2(1): 1015.

Copyright © 2021 Mirton N Prandini. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



Figure 1: Brain MRI showing a heterogeneous lesion at left Sylvian fissure.



Figure 4: Post-operative Cerebral angiography.



Figure 2: Left carotid angiography.



Figure 3: Brain washing until temperature drops to 30°C.

Discussion

The clinical use of hypothermia in the treatment of brain aneurysms remains a topic of great debate between its benefits and possible side effects.

Complex cerebral aneurysms are challenging diseases, in which conventional treatment demonstrates high morbidity, with sequela mainly resulting from low flow injuries associated with intraoperative maneuvers. Hypothermia appears in this context as a possible tool to improve brain protection, decreasing energy demand and allowing longer time for surgical manipulation of this type of aneurysm [1,2].

Current systematic reviews still report a lack of high-quality studies, and the analysis of the data as a whole does not yet allow the construct of guidelines or consensus for their routine application. In general, they suggest conducting randomized clinical trials so that

more robust conclusions can be drawn [3-7].

A study published in NEJM in 2005, by Todd et al. [8] described the outcomes of an analysis of 1,001 patients undergoing hypothermia (33°C) or normothermia during the treatment of subarachnoid hemorrhage in less severe patients (WFNS I, II or III), without finding any clinical benefit from its use.

On the other hand, many case series studies are showing concrete benefits of using hypothermia, including a cohort of patients with severe neurological conditions.

Choi et al. [9] described a series of 22 cases of patients with severe subarachnoid hemorrhages (Hunt-Hess 4 and 5) and observed better clinical results in patients undergoing mild therapeutic hypothermia (34.5°C) [9].

Karibe et al. [10] observed better cerebral blood flow in sPECT (single-Photon Emission Computed Tomography) in the post-operative period when 24 patients with ruptured brain aneurysms were paired in patients submitted to mild hypothermia (33.5°C).

Gal et al. [11] also demonstrated better clinical results in patients undergoing mild hypothermia (34°C) when comparing their cohort of 89 patients with the previous history of their hospital during the treatment of subarachnoid hemorrhages. One of the major challenges in the treatment of subarachnoid hemorrhages is the management of cerebral vasospasm. Nagao et al. published the benefits of mild hypothermia in patients (32°C to 34°C) in the treatment of cerebral vasospasm [12,13].

To prevent whole-body hypothermia and its side-effects, regional hypothermia was used in some studies, with good outcomes in diseases affecting the central nervous system [14,15].

Regional mild hypothermia was demonstrated to offer good protection in cases of temporary arterial circulation reduction of the brain parenchyma. The technical procedure we have developed only requires the brain parenchyma to be washed with a solution of saline and Papaverine hydrochloride at 10°C to keep the brain temperature around 30°C (Figure 4). The procedure starts as soon as the dura is opened lasting until its closure.

For temporary clipping in aneurysm surgery, our experience demonstrated that such a procedure was helpful in maintaining the cellular activity free of deleterious effects of ischemia. More than 500 aneurysms were operated on over the last 20 years. Temporary

clipping records varied from 6 min to 26 min. No ischemic complications were reported.

Conclusion

In very special cases, arterial reconstruction through termino-terminal anastomosis may be required to treat fusiform aneurysms. In such occasions some kind of brain protection becomes necessary. Local-regional mild hypothermia (30°C) demonstrated to be a good tool for parenchymal neuroprotection in cases of temporary reduction of arterial cerebral circulation. Regional hypothermia may also prevent adverse events that may occur in whole body hypothermia.

References

- Escosa-Bagé M, Sola RG, Liberal-González R, Caniego JL, Castrillo Cazón C. Aneurisma fusiforme de la arteria cerebral media [Fusiform aneurysm of the middle cerebral artery]. *Rev Neurol*. 2002;34(7):655-8.
- Solomon RA, Smith CR, Raps EC, Young WL, Stone JG, Fink ME. Deep hypothermic circulatory arrest for the management of complex anterior and posterior circulation aneurysms. *Neurosurgery*. 1991;29(5):732-7.
- Li LR, You C, Chaudhary B. Intraoperative mild hypothermia for postoperative neurological deficits in people with intracranial aneurysm. *Cochrane Database Syst Rev*. 2016;3:CD008445.
- Zhao ZX, Wu C, He M. A systematic review of clinical outcomes, perioperative data and selective adverse events related to mild hypothermia in intracranial aneurysm surgery. *Clin Neurol Neurosurg*. 2012;114(7):827-32.
- Li LR, You C, Chaudhary B. Intraoperative mild hypothermia for postoperative neurological deficits in intracranial aneurysm patients. *Cochrane Database Syst Rev*. 2012;15(2):CD008445.
- Hindman BJ, Todd MM, Gelb AW, Loftus CM, Craen RA, Schubert A, et al. Mild hypothermia as a protective therapy during intracranial aneurysm surgery: A randomized prospective pilot trial. *Neurosurgery*. 1999;44(1):23-32.
- Sato K, Sato K, Yoshimoto T. Systemic and cerebral haemodynamics during craniotomy under mild hypothermia in patients with acute subarachnoid hemorrhage. *Acta Neurochir (Wien)*. 2000;142(9):1013-9.
- Todd MM, Hindman BJ, Clarke WR, Torner JC. Mild intraoperative hypothermia during surgery for intracranial aneurysm. *N Engl J Med*. 2005;352(2):135-45.
- Choi W, Kwon SC, Lee WJ, Weon YC, Choi B, Lee H, et al. Feasibility and safety of mild therapeutic hypothermia in poor-grade subarachnoid hemorrhage: Prospective pilot study. *J Korean Med Sci*. 2017;32(8):1337-44.
- Karibe H, Sato K, Shimizu H, Tominaga T, Kosu K, Yoshimoto T. Intraoperative mild hypothermia ameliorates postoperative cerebral blood flow impairment in patients with aneurysmal subarachnoid hemorrhage. *Neurosurgery*. 2000;47(3):594-9.
- Gal R, Smrcka M. Mild hypothermia for intracranial aneurysm surgery. *Bratisl Lek Listy*. 2008;109(2):66-70.
- Nagao S, Irie K, Kawai N, Nakamura T, Kunishio K, Matsumoto Y. The use of mild hypothermia for patients with severe vasospasm: A preliminary report. *J Clin Neurosci*. 2003;10(2):208-12.
- Nagao S, Irie K, Kawai N, Kunishio K, Ogawa T, Nakamura T, et al. Protective effect of mild hypothermia on symptomatic vasospasm: A preliminary report. *Acta Neurochir Suppl*. 2000;76:547-50.
- Wagner KR, Zuccarello M. Local brain hypothermia for neuroprotection in stroke treatment and aneurysm repair. *Neurol Res*. 2005;27(3):238-45.
- Keller E, Mudra R, Gugl C, Seule M, Mink S, Fröhlich J. Theoretical evaluations of therapeutic systemic and local cerebral hypothermia. *J Neurosci Methods*. 2009;178(2):345-9.