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Introduction

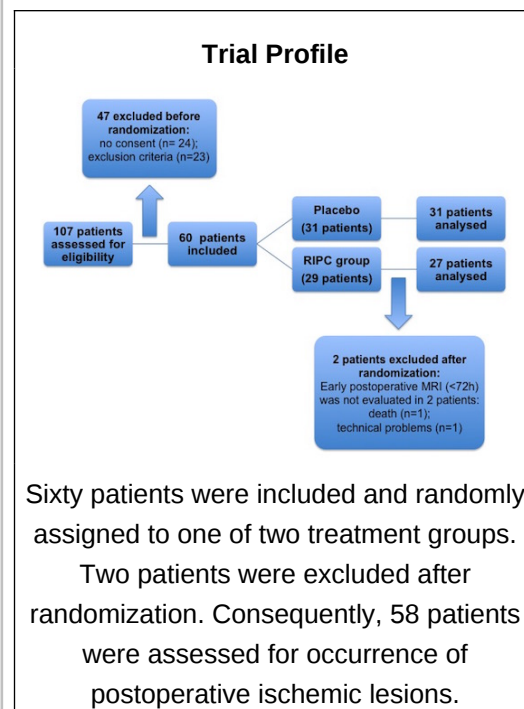
Postoperative ischemia is a frequent phenomenon in patients with brain tumors and is associated with postoperative neurological deficits and impaired overall survival [1-3]. Previous clinical and experimental studies have shown that the application of a brief ischemic stimulus not only in the target organ but also in a remote tissue can prevent ischemia [4]. We hypothesized that remote ischemic preconditioning (rIPC) in patients with brain tumors undergoing elective surgical resection reduces the incidence of postoperative ischemic tissue damage and its consequences.

Methods

Sixty patients were randomly assigned to two groups, with 1:1 allocation, stratified after tumor type (glioma or metastasis) and previous treatment with radiotherapy. Remote ischemic preconditioning was induced by inflating a blood pressure cuff placed on the upper arm three times for 5 minutes at 200 mmHg in the treatment group after induction of anesthesia. Between the cycles, the blood pressure cuff was released to allow reperfusion. In the control group no preconditioning was performed. Early postoperative MR images were evaluated blinded to randomization for the presence of ischemia and its volume.

Results

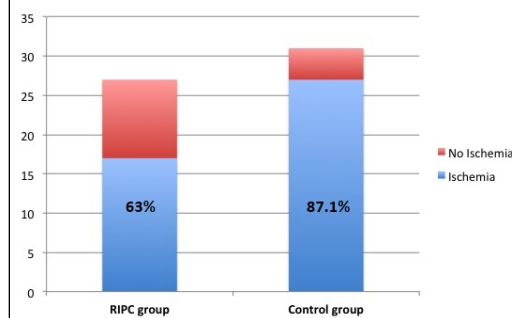
Fifty-eight of the 60 patients were assessed for occurrence of postoperative ischemia. Of these 58 patients, 44 (75.9%) had new postoperative ischemic lesions. The incidence of new postoperative ischemic lesions was significantly higher in the control group (87.1%) (27/31) than in the rIPC group (63.0%) (17/27) ($p=0.03$). The median infarct volume was 0.36 cm³ (IR: 0.0- 2.35) in the rIPC group compared with 1.30 cm³ (IR: 0.29- 3.66) in the control group ($p=0.09$).



Sixty patients were included and randomly assigned to one of two treatment groups.

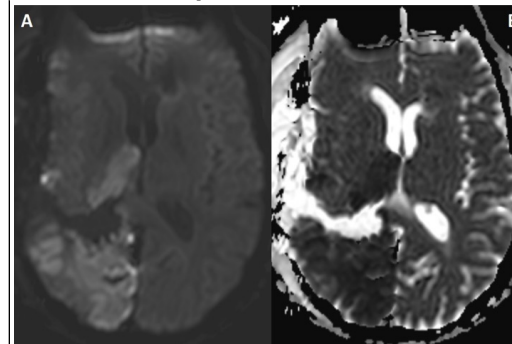
Two patients were excluded after randomization. Consequently, 58 patients were assessed for occurrence of postoperative ischemic lesions.

Remote Ischemic Preconditioning and Postoperative Ischemia



The bar graph shows that the incidence of postoperative ischemic lesions was significantly higher in the control group (87.1%) than in the RPC group (63%). Pearson chi-square test $p=0.03$

Postoperative Ischemia



A shows a postoperative diffusion weighted image (DWI, b1000), and B the corresponding apparent diffusion coefficient (ADC)-map. The images (A,B) show an example of a large postoperative large ischemia with restricted diffusion in the posterior lobe and thalamus.

Conclusions

Application of rIPC significantly reduced the incidence of postoperative ischemic tissue damage in patients undergoing elective brain tumor surgery. This is the first study indicating a benefit of rIPC in brain tumor surgery.

Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) Understand the importance of ischemic preconditioning in the surgical treatment of brain tumors;
- 2) Discuss the prognostic relevance of postoperative ischemic events in patients with brain tumors;
- 3) Discuss future strategies for reducing the incidence of postoperative ischemic changes in these patients.

References

1. Gempt J, Gerhardt J, Toth V, Hüttinger S, Ryang Y-M, Wostrack M, et al. Postoperative ischemic changes following brain metastasis resection as measured by diffusion-weighted magnetic resonance imaging. *J Neurosurg*. 2013 Dec;119(6):1395–400.
2. Gempt J, Förschler A, Buchmann N, Pape H, Ryang Y-M, Krieg SM, et al. Postoperative ischemic changes following resection of newly diagnosed and recurrent gliomas and their clinical relevance. *J Neurosurg*. 2013 Apr;118(4):801–8.
3. Bette S, Wiestler B, Kaesmacher J, Huber T, Gerhardt J, Barz M, et al. Infarct volume after glioblastoma surgery as an independent prognostic factor. *Oncotarget*. 2016 Sep 20;7(38):61945–54.
4. McCrindle BW, Clarizia NA, Khaikin S, Holtby HM, Manlhiot C, Schwartz SM, et al. Remote Ischemic Preconditioning in Children Undergoing Cardiac Surgery With Cardiopulmonary Bypass: A Single-Center Double-Blinded Randomized Trial. *J Am Heart Assoc*. 2014 Jul 29;3(4):e000964–e000964.