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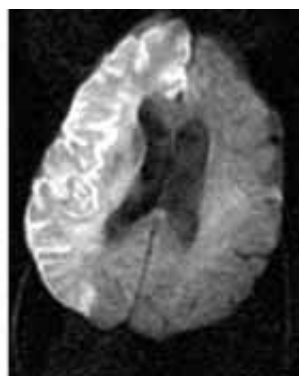
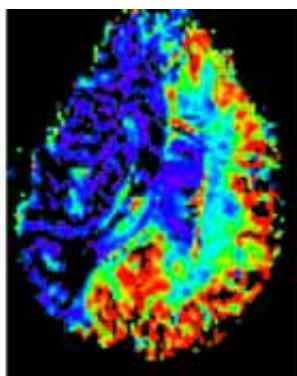
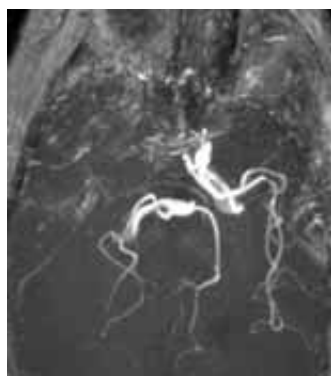


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Anesthesia for neurosurgery neuroprotection 2005

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INTRAOPERATIVE NEUROPROTECTION

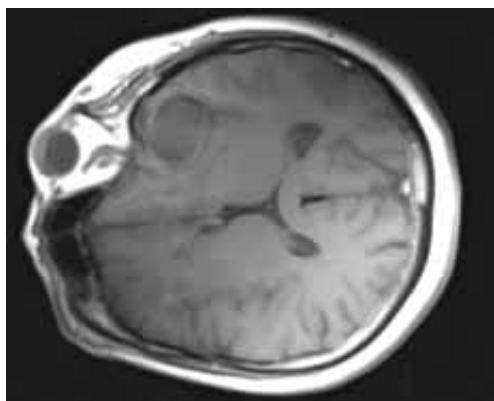
- Mrs J – 61 year old woman with no previous illnesses
- Presented to her family physician, August 2002, complaining of bifrontal headaches, sometimes steady, sometimes pulsating
- Scheduled for a CT scan in December 2002

- CT scan reveals a giant aneurysm involving the right middle cerebral artery, shown here using mobile intraoperative MRI

INTRAOPERATIVE NEUROPROTECTION

- Standard angiography reveals a giant aneurysm involving the R middle cerebral artery

INTRAOPERATIVE NEUROPROTECTION



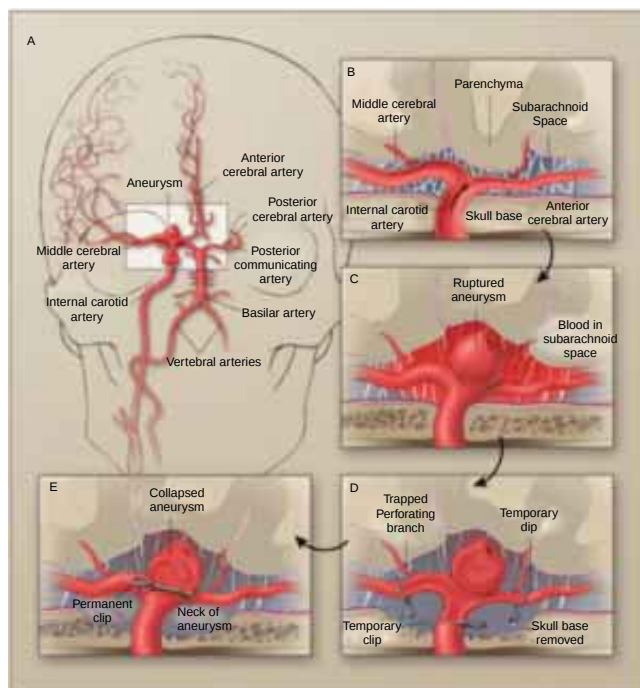
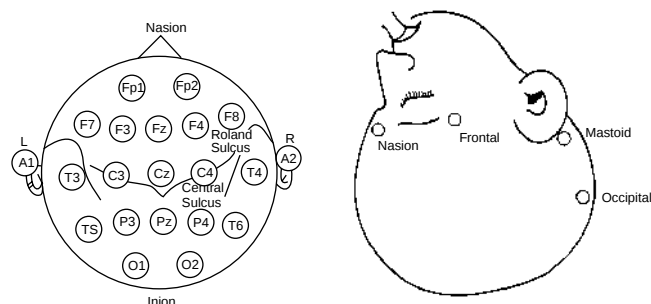
INTRAOPERATIVE NEUROPROTECTION

- 3-D reconstruction of the aneurysm revealed
 - Clot within the aneurysm
 - Several associated arteries that were at risk for occlusion during the attempted clipping



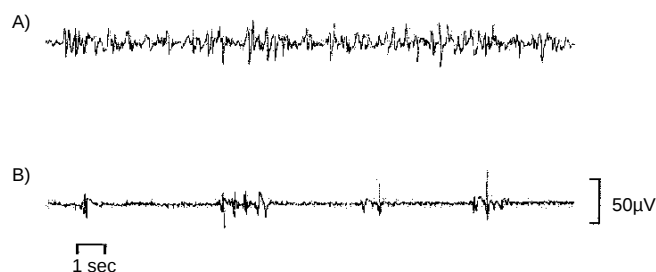
- Brain Monitoring
- “Protection”
 - Propofol/fentanyl/rocuronium
 - Desflurane/O₂
 - Cooled IV fluids - 32°C nasopharyngeal temperature
 - EEG - CSA FP1/O1, FPO₂/O₂
 - Propofol to burst suppression

EEG POSITIONING



BURST SUPPRESSION ON THE EEG (RAT)

Anesthesiology, 84: 1475



Anesthesiology, 84:1475.

ANESTHETIC PLAN

- Induction
- Maintenance
- Cooling

SURGICAL ISSUES

- Clip applied — increase in size of aneurysm because of ↓ emptying
- Temporary clip applied to allow application of a series of clips across the aneurysm: 22 min



SPECIFIC QUESTIONS

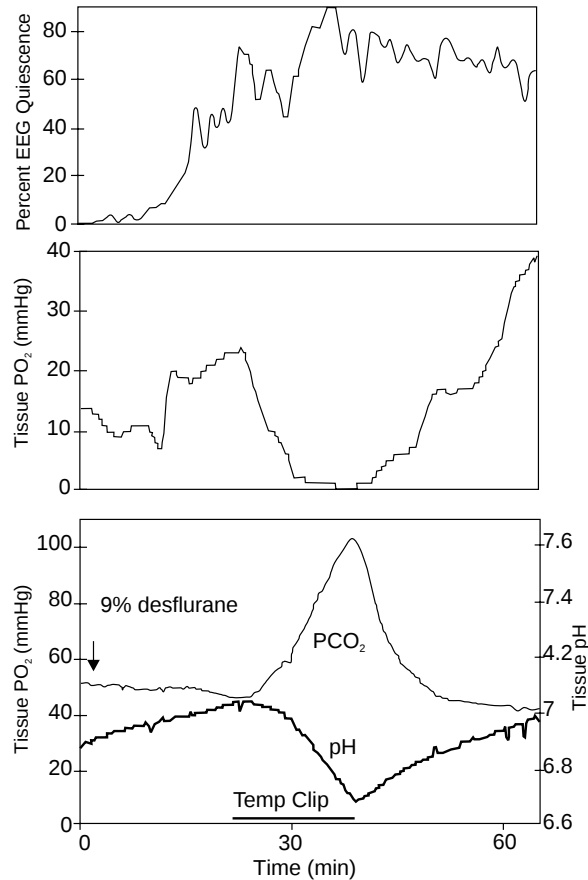
- How long can we safely leave a temporary clip on the MCA?
- Will the time be longer if we
 - cool the patient?
 - reduce metabolic activity in the brain with high doses of anesthetics
- Are intravenous agents more effective for brain protection than volatile anesthetics?

BRAIN PROTECTION WHILE THE CLIP IS ON?

- Increase supply. (Restore flow, ↑ collateral flow (↑ BP, ?volatile agent))
- Decrease demand. (Cool, ?anesthetics)
- Intervene in the ischemic cascade (magic bullet)

CHANGES DURING MCA CLIPPING (TEST OCCLUSION) HOFFMAN ET AL. SURG NEUROL 1998: 49

- Normothermia (35°C) , normotension, EEG quiescence with 9% desflurane
- Clip time: 16 minutes



CHANGES DURING MCA CLIPPING (TEST OCCLUSION) HOFFMAN ET AL. SURG NEUROL 1998: 49

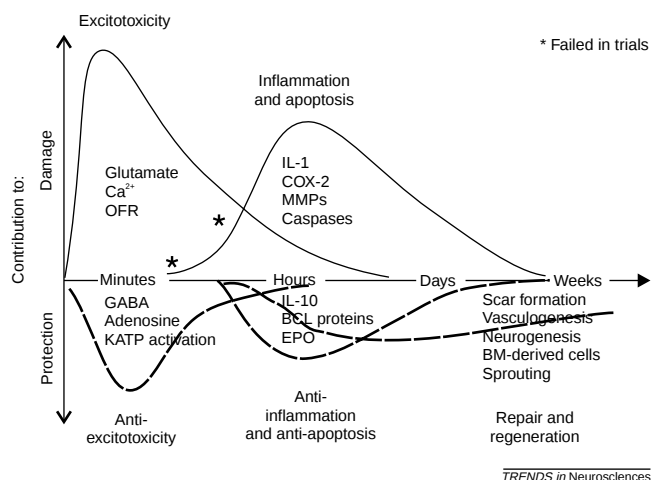
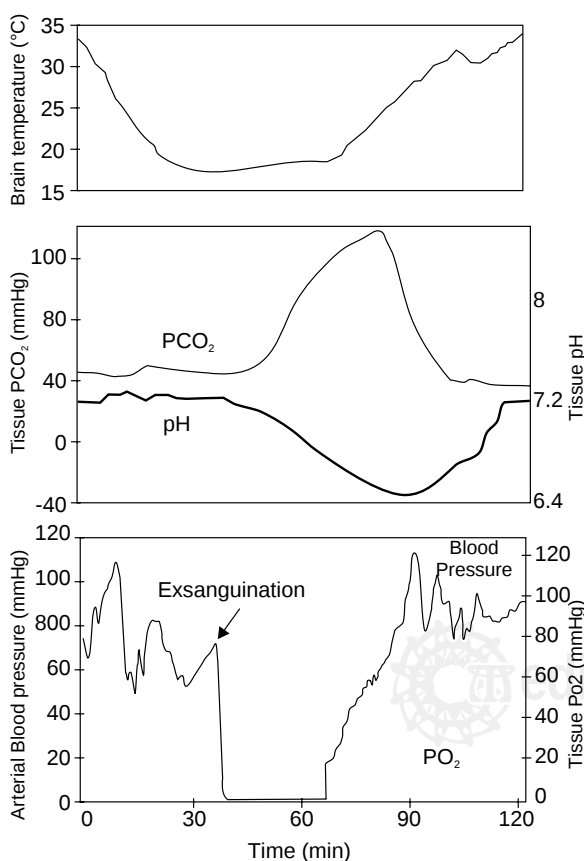
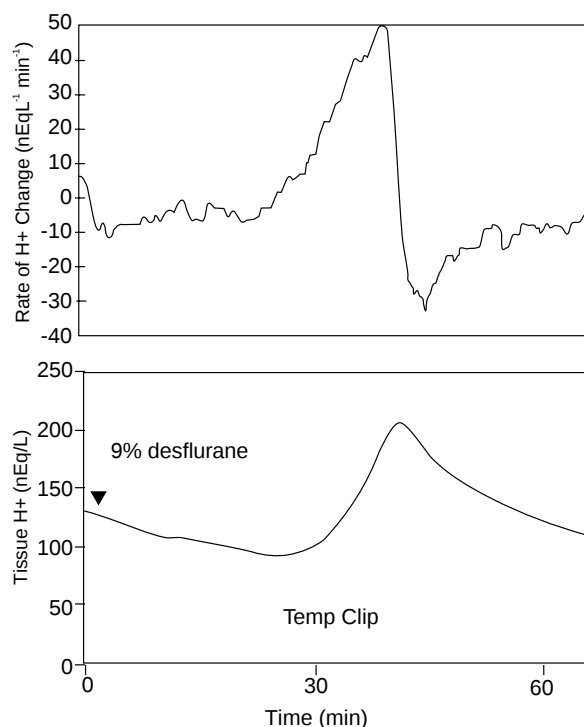
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CHANGES DURING MCA CLIPPING (TEST OCCLUSION) HOFFMAN ET AL. SURG NEUROL 1998: 49

- Hypothermia (18°C) , cardiac arrest

CLINICAL EVIDENCE OF NEUROPROTECTION

- 1995 - thrombolysis with tPA improves outcome in stroke patients when administered within 6 hrs. 160/1000 patients improved. NEJM 333:1581
- 2002 - Hypothermia after cardiac arrest study group (HACASG) NEJM 346:549 160/1000 improved



CLINICAL NEUROPROTECTION

- The mechanism(s) of cytoprotection by hypothermia is(are) unknown. The main candidates under investigation currently are:
 - Reduction of excitotoxicity
 - Interference with NO
 - Interference with cytochrome pathways
- Reduction of metabolism has *not* been shown to be related to protective effects of hypothermia

TEMPORARY MCA OCCLUSION LAVINE ET AL. J NEUROSURG 1997; 87

- Retrospective review 49 patients with temporary clips, one surgeon
- Lumbar drain for to facilitate CSF drainage/retraction
- Mannitol 1 g/kg, normothermia, normocapnia
- Variety of "IVBP" techniques - propofol, etomidate or pentobarbital
- Several different administration techniques - bolus, primary anesthetic
- No IVBP - Isoflurane

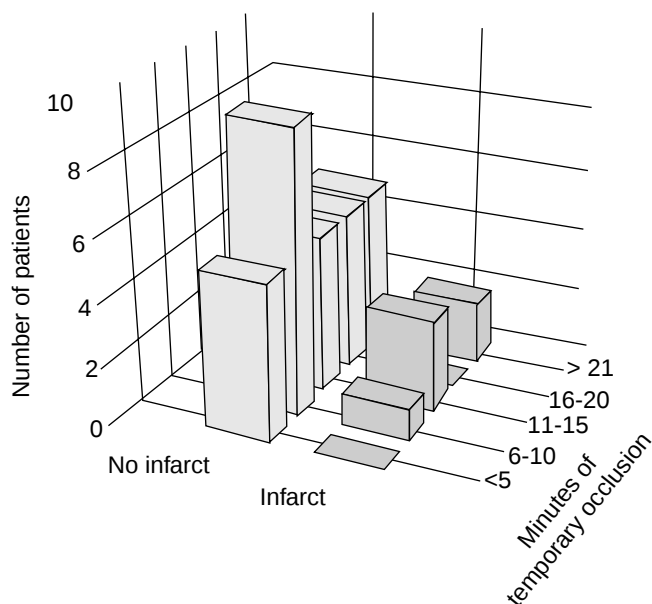
CHARACTERISTICS OF TREATMENT GROUPS

Characteristic	IVBP (38)	No IVBP (11)
Age (yrs)	47 ± 12	49 ± 12
Size (mm)	10 ± 4	9 ± 5

Grade 0	24%	27%
Grade I	47%	55%
Grade II	5%	9%
Grade III	21%	9%

IVBP GROUP OCCLUSION: TIME TO CEREBRAL INFARCTION

- 25% of patients with occlusion of at least 11 min. suffered infarction
- 83% (5/6) patients who infarcted have undergone occlusion at least 11 min
- Conclusion of authors: 10 min.



SAFE DURATION FOR TEMPORARY CLIP?

- Several of our surgeons consider that 5 minutes is the ischemic limit and they try to reperfuse after 3 minutes of occlusion of an end artery

IN PATIENTS WITH TEMPORARY CLIP > 10 MINUTES:

- In patients with IVBP: 5/23 had focal infarction
- In patients without IVBP: 4/4 had focal infarction
- These data suggest that the patients that received the anesthetics that included IVBP were “protected” ($P < 0.005$)

PROBLEMS

- Retrospective
- NO information about hemodynamics or anesthetic administration
- End-points of IVBP followed for etomidate and propofol, not for pentobarbital
- No information about proportion of patients receiving different types of “IVBP”

IN SUMMARY

- There is currently no “evidence” to support the concept that the risk from temporary clip application > 10 minutes can be reduced by manipulation of physiologic or pharmacological variable

IN SUMMARY

- Current strategies are based upon reasonable extensions of preclinical (animal) studies in experimental stroke
- Since the benefit of these strategies is unknown, the risk must be very low to be acceptable

ACKNOWLEDGMENTS

Dr. Sheldon Roth, collaborator Naaznin Samanani, research associate CAS, CIHR, and the Department of Anesthesia, University of Calgary

