Artículo:

Anesthesia for neurosurgery
neuroprotection 2005

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Anesthesia for neurosurgery neuroprotection 2005

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

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

INTRAOPERATIVE NEUROPROTECTION

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

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

- 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 (HACSG) 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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>IVBP (38)</th>
<th>No IVBP (11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>47 ± 12</td>
<td>49 ± 12</td>
</tr>
<tr>
<td>Size (mm)</td>
<td>10 ± 4</td>
<td>9 ± 5</td>
</tr>
</tbody>
</table>
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.

**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

**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 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

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