Individual hypothermic targeted temperature management (TTM) in severe subarachnoid hemorrhage leads to favorable outcome – results of a case series

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Background:

Severe subarachnoid hemorrhage (SAH) is frequently complicated by vasospasm, delayed cerebral ischemia (DCI) and increased intracranial pressure (ICP). So far there is no evidence based therapy. A prophylactic hypothermia treatment could not show any benefit.[1] We use an individual hypothermic targeted temperature management for severe vasospasms to avoid DCI and increased ICP as described before.[2]

Methods:

Nine Patients with severe aneurysmatic SAH (Fisher III°, WFNS 1 n = 4, WFNS 2 n = 3 and WFNS 5 n= 2) were treated by TTM (*Table 1*) when they developed recurrent ICP-crisis and/or severe vasospasm diagnosed by transcranial duplex sonography and confirmed by angiography. Once these complications were detected, body core temperature (BCT) was rapidly decreased to 35°C or 33°C by surface cooling. Temperature monitoring was performed by intravesicular temperature measurement. Additionally intraarterial spasmolysis with nimodipine and papavarine was performed on individual decision for one or several times. Hypothermia < 36°C was sustained for 116 – 318 hours (<35°C 185 +/- 133h, < 34°C 122 +/- 21h, ≥33°C 88 +/-72h).Rewarming was performed gradually by 1°C (0,1°C/ hour) if surrogate parameters for macrovascular vasospasm and ICP were regular (*Figure 1*). In case of worsening BCT was decreased again to the last effective level.

Results:

By hypothermic TTM ICP could be normalized in all patients (< 20mmHg) and intracerebral stream velocities of middle cerebral artery (MCA) could be reduced. 6 patients showed a modified Rankin Scale (mRS) ≤ 2 at discharge to rehabilition and improved to 0 – 1 in follow-up examinations. Only 3 patients showed DCIs being associated with severe disabilities. These patients died due to septic shock with therapy limitation or brain edema in the course. Nine patients developed an infection during treatment (pneumonia n=6, ventriculitis n=3).

Patient characteristics	
Sex (f:m)	5:4
Age (years)	56.5 (46 - 74)
Hypothermia < 36°C	116 – 318h
Hypothermia ≤35°C	185 +/- 133h
Hypothermia ≤ 34°C	122 +/- 21h
Hypothermia ≥33°C	88 +/-72h
ICP – Maximum (cmH2O)	
- ≥ 36°C (mean)	24.8 (0 - 45)
- < 36°C (mean)	17.8 (0 - 25)
MCA maximum velocity (cm/s)	
- ≥ 36°C (mean)	294.4 (140 – 450)
- < 36°C (mean)	242.2 (100 – 480)
Lindegaard-Index	
- ≥ 36°C (mean)	5.2
- < 36°C (mean)	4.2
Spasmolysis (number)	1.8 (0 - 4)
DCI (yes : no)	6 : 3
- Clinical relevant	4
mRS at discharge (number)	1 (1), 2 (5), 6 (3)

Table 1: Patient's characteristics and results

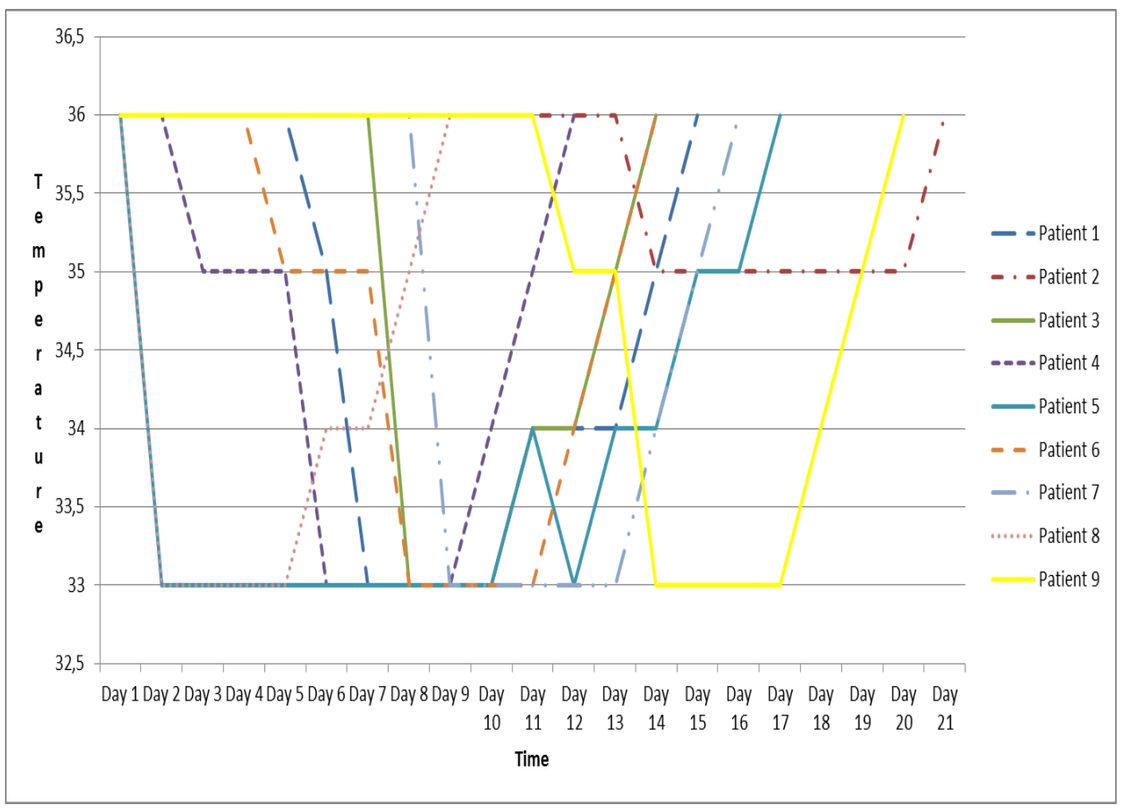

Figure 1: Individual trend of body core temperature for each single patient (°C, y-axis) over time (day, x –axis).

Conclusion:

In a large proportion of our patients our TTM strategy improved surrogate parameters for vasospasms and normalized intracranial pressure. Therefore it led to a favorable outcome and should be investigated further in a controlled randomized trial.

Disclosure: No competing financial or comercial interests exist.

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