Hyppothermia for spinal cord injury

To The Editor: We read with great interest the recent paper by Hansebout and Hansebouot on local cooling for spinal cord injury (SCI) (Hansebout RR, Hansebouot CR: Local cooling for traumatic spinal cord injury: outcomes in 20 patients and review of the literature. Clinical article. J Neurosurg Spine 20: 550–561, May 2014). The authors describe the long-term clinical outcome in 20 patients who had American Spinal Injury Association Impairment Scale (AIS) Grade A SCI in either the cervical spine (n = 14) or thoracic spine (n = 6). This report includes the 10 patients described by the author in a previous report in 1984. The patients were accrued for 10 years starting from 1977 with a mean follow-up of around 5 years. Dexmethasone was given to patients for 18 days. A local cooling apparatus placed in the epidural space cooled the dura to 6°C for up to 4 hours while the instrumentation was being done after decompression. Overall, 65% of the patients improved from AIS Grade A to B, C, or D, with 2 patients regaining ambulatory function. The outcomes reported in this study are better than what would usually be expected for an AIS Grade A injury.

Local spinal cord cooling was more popular in 1970s and early 1980s when several groups had used local cooling in humans and animals with variable but generally good results. The potential benefits of providing hypothermia directly to the injured region obviated many of the risks of deep systemic hypothermia and resulted in many studies in large animals, leading to application in humans. Local cooling trials for SCI in humans in that era were facilitated by the common performance of laminectomy as part of the treatment regimen. Wide laminectomy particularly after cervical injuries is now much less common, particularly with the advent of anterior cervical plating for cervical fracture-dislocations. While the outcomes of some of these studies were encouraging, several factors, like the lack of control group, variable treatment window, confounding variables such as the administration of steroids, and small sample size led to failure in drawing any strong conclusions and gradual abandonment of local hypothermia for SCI.

In contrast, there is very encouraging data from our center that modest systemic hypothermia (32°–34°C) can lead to both histological and functional recovery after SCI in animal models. We have reported our technique and clinical data on the outcome and safety profile of modest systemic hypothermia for 48 hours after cervical AIS Grade A SCI. In our initial study, 6 of the 14 patients (42.8%) improved one AIS grade or better. The majority of the patients who improved in this original study did so within the first 3 months, but none did so within the first 2 weeks. This suggested that patients with spinal shock were not inadvertently included in the study. In our subsequent follow-up study, which included the original group as well as subsequent patients accrued over a 6-year period (n = 35), 15 of the 35 patients (42.8%) improved at least one AIS grade or greater. This compared favorably to published natural history outcome data. The current guidelines from the AANS/CNS joint section on spine provide a Grade C (Level 4 evidence) for the use of modest systemic hypothermia for SCI.

The authors acknowledge some of the drawbacks of the current local hypothermia study. The most obvious is the need for laminectomy before cooling can be started. At that time, cooling was continued for 4 hours while fusion was being performed. In the current era of spinal instrumentation, constructs are shorter, stronger, and faster to apply, with many patients avoiding decompression via laminectomy with restoration of alignment. Also, this study was done prior to the modern imaging era, which means that we do not know the extent of injury to the spine and spinal cord, and the injury could range from a bad form of central cord damage (with better prognosis) to complete cord transection (with no chance of improvement). With systemic hypothermia, cooling can potentially be initiated at the time of injury by administering intravenous ice-cold saline, such as in the Advanced Cardiac Life Support (ACLS) guidelines for the reduction of neurological brain injury after cardiac arrest. With modest hypothermia, many of the complications of deep systemic hypothermia can be avoided while preserving many of its benefits. Endovascular cooling is fast and reliable, and, unlike local hypothermia, can be started in the emergency department without delaying the surgery if the patient is going to the operating room. It also can be administered to patients who do not need surgery. Considering that there is no proven therapy for SCI and there is now a growing body of literature supporting the use of hypothermia for this devastating injury, larger multicenter trials should be conducted to further assess safety and efficacy in a prospective, randomized study.

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Disclosure

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References


RESPONSE: We wish to thank Drs. Ahmad and Levi for their excellent research on hypothermia for traumatic SCI and their comments on our cord-cooling series.

When this series was first conceived, it was decided to include only patients with neurologically complete SCI as they do not often recover significant neurological function, allowing improvement to be more easily attributed to the intervention. Corticosteroid therapy was standard treatment at the time and it was not considered ethical to withhold it. We wanted to begin cooling early, since the secondary autodestructive processes in severe SCI can progressively aggravate spinal cord damage, particularly within the first 8 hours of trauma.1 It was extremely difficult to get severely injured patients into the operating room for cooling in this time period; we consequently used only plain radiographs and systemic emergency management to save time. During this study, some of the more modern imaging modalities, such as CT scanning, were available, but MRI was in its inception. We did not obtain CT scans as, during the period in which the study was completed, doing so would have substantially increased the time to application of cooling. We did visualize the dura and, occasionally, the cord through torn dura at the site of injury during decompression. In one case a complete cord transection was noted, and cooling was therefore not undertaken.

There has been discussion about the comparative beneficial effects of deep local versus modest systemic hypothermia. We hypothesized that selectively and deeply cooling injured tissue would be most likely to arrest the progressive secondary autodestructive processes within the spinal cord while avoiding potential cardiac, respiratory, or other complications of systemic hypothermia. Lower temperatures are more safely and easily obtained in target tissues through the use of local cooling. A question is whether this profound yet local decrease in temperature is very rapid using local cooling, likely being reached within 5 minutes, according to studies in large animals.22

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