Radiant Medical Reprieve™ Endovascular Temperature Therapy System

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Rationale for Cooling

In the late 1930s, Temple Fay, a visionary neurosurgeon from Philadelphia, PA, first used therapeutic cooling to treat his patients with otherwise inaccessible tumors (1,2). In the early 1950s, Bigelow (3), from Boston, MA, pioneered the use of deep (16–28°C) hypothermia to protect the brain during experimental cardiac surgery, whereas Rosomoff from Pittsburgh, PA (4), was the first to demonstrate deep hypothermic cerebral protection following trauma in dogs in 1959. The 1960s saw an upsurge of moderate (28–33°C) and deep hypothermia during aneurysm, spinal cord and cardiac surgery, and in the management of neurotrauma.

In recent years, a wealth of animal studies demonstrated that mild-to-moderate hypothermia (32–35°C) effectively protects the brain when induced during or shortly after cerebral ischemia (5). Although not entirely understood, hypothermia induces a variety of responses in the ischemic brain, including reduction in metabolic and enzymatic activity, glutamate release and reuptake, inflammation, and reactive oxidant production. Presumably, mild-to-moderate hypothermia influences tissue remodeling after stroke and diminishes intracerebral hemorrhage and may therefore prove an excellent adjunct to thrombolytic therapy for acute ischemic stroke (6). It may be too simplistic to conclude that hypothermia is beneficial because it induces several neuroprotective actions, analogous to the advocated combinatorial neuroprotective strategies (7,8). Nevertheless, the multiple, synergistic effects of hypothermia that affect ischemia and reperfusion have great potential to be successful in clinical trials. It is important that hypothermic protection is not simply proportional to the reduction in cerebral metabolic rate and that the traditional view that “colder is better” is being questioned (9). Many of the early techniques were abandoned because of systemic hazards, such as cardiac irritability, pulmonary infections, or coagulopathies, particularly with deep and profound systemic hypothermia.
Surface cooling to mild to moderate degrees of hypothermia is the mainstay of therapeutic cooling in most institutions. The effectiveness and shortcomings of this approach concerning the reduction of shivering, patient comfort, and the initiation and continuation of the thermal effect are reviewed in an article accompanying this edition of NCC (10). Fueled by the positive results of recent experimental work and clinical trials, novel approaches to apply therapeutic cooling are being devised and cooling technology developed. One such example with ample experience in the preclinical and clinical setting is intravenous heat exchanging in the awake, nonintubated patient.

**Technology**

The catheter-based Radiant Medical Reprieve™ Endovascular Temperature Therapy System (Redwood City, CA) (Fig. 1) provides rapid cooling, controlled rewarming and precise achievement and maintenance of a user-defined target temperature. The Reprieve System has been used extensively in clinical tri-