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(54) Title: PROTECTIVE HELMET WITH A PELTIER ELEMENT FOR CRANIAL COOLING

(57) Abstract: A helmet is coupled to a peltier element. One side of the peltier element (the cool side) is coupled to a gel form that is coextensive with the entire interior surface of the helmet. This gel form encases the skull, inducing localized hypothermia when power is supplied to the peltier. The hot side of the peltier plate faces outward. The heat is dissipated through a vent in the top of the helmet. The helmet can be used to induce hypothermia in skull trauma patients, or as a protective helmet for disabled children, particularly those suffering from cerebral palsy, or in sports and exercise.

PROTECTIVE HELMET WITH A PELTIER ELEMENT
FOR CRANIAL COOLING

Field of the Invention

5 This invention relates to induction of
hypothermia in humans.

Background of the Invention

Moderate hypothermia is effective in preventing
secondary brain damage while reducing cerebral ischemia
in patients presenting with skull trauma. An increased
10 CMRL (cerebral metabolic rate for lactate) is a strong
indicator of cerebral edema in these patients. Moderate
hypothermia for 24-48 hours decreases the CMRL and
markedly reduces intracranial hypertension. Patients
treated with hypothermia experience significantly fewer
15 neurological deficits and have better clinical outcomes
than other patients. Many researchers believe that
induced hypothermia suppresses brain inflammation by
reducing production of interleukin 1-beta. Moderate brain
chill is also thought to inhibit the release of
20 glutamate, a potentially lethal substance.

Various techniques for inducing hypothermia
exist. Two commonly used techniques involve (1) wrapping
the patient in water blankets and (2) forced air cooling.
Recently, a number of intensive care units have begun to
25 induce hypothermia by decreasing the temperature of the
circulating blood. One end of a piece of tubing is
inserted into the leg. The tubing is placed in a water
bath maintained at about 28 to 30 degrees Celsius. Blood
is drawn into the tubing, cooled and channeled back into
30 the body. After treatment (generally; this type of

- 2 -

treatment is continued for approximately 24 to 48 hours), normal body temperature is restored by slowly and steadily increasing the temperature over a 24 hour time period.

5 All of these techniques suffer from various drawbacks. First, since the chilling element is not directly applied to the skull but to other parts of the body, it is not possible to isolate the area being treated. Second, total body hypothermia is not always
10 desirable, especially because it induces potentially hazardous side effects that require additional monitoring. Lastly, induction of hypothermia also alters the speed at which the body metabolizes many drugs, making it difficult to determine an optimal dosage or
15 predict a therapeutic benefit.

Accordingly, it would be advantageous to provide an improved technique for inducing hypothermia in skull trauma patients. This advantage achieved by a method and system whereby a protective helmet is coupled
20 to a peltier element. Cooling can be selectively applied to the cranium, rather than remote areas of the body.

Summary of the Invention

The invention provides a method and system for inducing hypothermia in medical patients.

25 In a first aspect of the invention, a helmet is coupled to a peltier element. In addition to their use as thermoelectric generators, peltier elements can be used as a heat pump. Peltier elements are known in the art. One side of the peltier element (the cool side) is
30 coupled to a gel form that is coextensive with the entire interior surface of the helmet. This gel form encases the skull, inducing localized hypothermia when power is supplied to the peltier plate. The hot side of the peltier plate is faces outward. The heat is dissipated
35 through a vent in the top of the helmet.

- 3 -

In a second aspect of the invention, the peltier element can be coupled to a battery pack, so it can be used in ambulatory patients.

5 In a third aspect of the invention, the peltier plate is coupled to a temperature control center that allows the temperature to be monitored and controlled. The temperature control center also receives feedback from numerous temperature sensors that are distributed throughout the surface of the helmet.

10 In a preferred embodiment, the invention can be used to induce hypothermia in skull trauma patients. In alternative embodiments, the invention can be used as a protective helmet for disabled children, particularly those suffering from cerebral palsy. In other alternative
15 embodiments, the invention can be used in sports and exercise.

Brief Description of the Drawings

Figure 1 is a block diagram showing a protective helmet, including a peltier element,

20 Detailed Description of the Preferred Embodiment

In the following description of the invention is described with regard to preferred process steps and structures. Those skilled in the art would recognize, after perusal of this application, that embodiments of
25 the invention can be implemented using circuitry or other structures adapted to particular process steps and structures, and that implementation of the process steps and structures described herein would not require undue experimentation or further invention.

30 The invention provides a method and system for inducing hypothermia in medical patients. As shown in Fig. 1, a helmet 10 is coupled to a peltier element or plate 12. In addition to their use as thermoelectric generators, peltier elements 12 can be used as a heat
35 pump. Peltier elements 12 are known in the art.

- 4 -

One side 24 of the peltier element 12 (the cool side) is coupled to a gel form 14 that is coextensive with the entire interior surface of the helmet 10. This gel form 14 encases the skull, inducing localized hypothermia when power is supplied to the peltier element 12.

The hot side 26 of the peltier element 12 faces outward. The heat is dissipated through a vent 16 through the top of the helmet 10.

As Fig. 1 shows, the peltier element 12 can be coupled to a battery pack 18, so it can be used in ambulatory patients. As Fig. 1 also shows, the peltier element 12 can be coupled to a temperature control center 20 that allows the temperature to be monitored and controlled. The temperature control center 20 also receives feedback from numerous temperature sensors 22 that are distributed throughout the surface of the helmet 10.

Although the preferred embodiment includes a peltier element as a cooling element, the cooling function could also be performed by circulating water, freon or other cooling apparatus.

Desirably, the invention can be used to induce hypothermia in skull trauma patients. The invention can alternatively be used as a protective helmet for disabled children, particularly those suffering from cerebral palsy.

In addition to providing cranial cooling for skull trauma patients, this invention could also be used as a head protector for a variety of sports, including bicycling, motorcycling, football, and many others.

Although preferred embodiments are disclosed herein, many variations are possible which remain within the concept, scope and spirit of the invention, and these variations would become clear to those skilled in the art

- 5 -

after perusal of this application.

Claims

We Claim:

1. Apparatus for chilling a cranium, said apparatus including a protective helmet disposed for wearing on the head; a gel form that encloses the interior surface of said helmet; and
5 a peltier plate for cooling said gel form.

