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## **A Novel Thermoregulatory System for Intraoperative Mild Hypothermia and Rewarming in Patients Undergoing Cerebral Aneurysm Clipping**

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**Background:** Mild hypothermia has been used during cerebral aneurysm surgery to reduce ischemic injury due to temporary vessel occlusion and brain retraction. However, slow rewarming may cause prolongation of postoperative mechanical ventilation and a greater degree of shivering (1-2). We have therefore assessed a novel thermoregulatory system (*Allon*, MTRE, Israel) for the induction of mild hypothermia and rewarming during cerebral aneurysm surgery.

**Materials and Methods:** Fifteen patients, 10 females and 5 men, age 19-68 (median 55) years, body weight 40-86 (median 70) kg, height 155-170 (median 164) cm Hunt and Hess aneurismal grades of I-III, scheduled for clipping of brain aneurysm were studied. Anesthesia was induced by propofol (1-2 mg/kg) and fentanyl (2.5-5  $\mu$ g/kg), and muscle relaxation by vecuronium (0.08 mg/kg). Anesthesia was maintained with 50% oxygen in air, propofol (4-10  $\mu$ g/kg/h), and additional fentanyl. Monitoring included electrocardiographic, pulse oximetric, capnographic, invasive arterial blood pressure and electroencephalographic measurements. After induction, patients were connected to the *Allon* system, which consists of a garment (which is wrapped around the body before induction), and a microprocessor system that controls the temperature of the water flowing in the garment, according to the core and the preset temperatures. To achieve a target rectal and esophageal temperature of 34°C by the time of clipping, the *Allon* system was set to 34°C, operating room temperature maintained at 20-22°C, and 1.5 liters of cold (approximately 10°C) saline were infused over 1 hour period. Intravenous magnesium sulphate in a dose of 4 gr was given over 20 minutes. Rewarming was achieved by setting the *Allon* system to 37°C and by administering IV fluids warmed to 37°C.

**Results and Discussion:** One patient was excluded because of rupture of the garment and loss of the heating/cooling water. All patients were normothermic on arrival to the operating room (36.6°C to 37.1°C). The median time from induction to aneurysm clipping was 210 minutes, at which time the range of core temperatures was 33.8°C to 34.1°C (median 33.8°C). After the beginning of rewarming, temperature rose by 0.2±0.2°C, 0.4±0.2°C, 1.1±0.4°C, and 1.7±0.4°C, in the first 15, 30, 45 and 60 minutes, respectively. Two patients reached a body temperature of 36.5°C 60 min after the beginning of rewarming, 2 more after 75 min, and all others after a maximum of 90 min. All patients were extubated at the end of surgery and had no postoperative shivering.

**Conclusions:** According to these preliminary results the *Allon* thermoregulation system enables rapid rewarming of mildly hypothermic patients so that body temperature is not a limiting factor in early extubation after the clipping of cerebral aneurysm. More data need to be collected mainly in obese patients and in patients with higher degrees of induced hypothermia.

**References:**

1. Hindman et al. Neurosurgery 1999: 23-33.
2. Baker et al. Anesthesiology 1994:361-367.

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