Rapid Whole Body Cooling in Large Animals: Effects on Heart Rate and Arterial Blood Pressure

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Introduction

There have been recent reports of a variety of cooling methods for reducing the body temperature of victims of post resuscitative syndrome. In this work we cooled a series of large (> 60 kg) domestic swine (n=6) using a whole body approach.

Objective

In this work Rapid Whole Body Cooling using large animals was assessed for its effects on the cardiovascular system.

Methods

Materials:
- The Thermosuit® system consists of:
  - a flexible surround suit system that contains the subject and
  - a separate pumping system which circulates a thin layer of ice-water directly over the patient's skin.

Subjects
- Six domestic swine weighing > 60 kg each
- Anesthetized using propofol and buprinnorphine and instrumented
  - ECG and arterial pressure monitoring
  - Thermocouple sensors in the pulmonary artery (PA), tympanic membrane and esophagus.

Hypothermic Protocol

Subject’s Initial PA temperature kept at approximately 37 °C

The cooling was performed with a flexible surround suit system that provided for
- a thin 0.5 cm layer of circulating ice water
- In direct skin contact held between 0.5° and 1.5° C.

The pumping system circulates the water volume of 20 liters at a rate of 15 liters per minute.

Outcome Measures
- Mean arterial pressure vs. time before and after cooling
- Average cooling rate, and temperature vs. time curve
- Statistical: 2-tailed T-test, mean, SD, Significance: p<0.05

Results

We interpret these changes as beneficial reductions in cardiac work while the subject is kept cool.

It is hypothesized that this is due to a reduction in total body metabolic demands.

Thus it is possible, in addition to positive neurological effects, that the process of rapid whole body cooling also may be effective in reducing total workload seen by the heart.

This may aid in further salvaging myocardium in such patients.

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*FDA-Approved Indication: Temperature reduction in patients where clinically indicated, e.g. in hyperthermic patients.