Author's response to reviews

Title: Cardiac condition during cooling and rewarming periods of therapeutic hypothermia after cardiopulmonary resuscitation

Authors:

Serdar Demirgan (serdardemirgan@hotmail.com)
Kerem Erkalp (keremerkalp@hotmail.com)
M. Salih Sevdi (salihsevdi@yahoo.com)
Meltem Turkay Aydogmus (#351; meltem72_3@hotmail.com)
Numan Kutbay (nktbay@hotmail.com)
Aydin Firincioglu (aydinfirincioglu@gmail.com)
Ali Ozalp (ali_ozalp3@hotmail.com)
Aysin Alagol (aysinalagol@yahoo.com)

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ABSTRACT:

Background: Hypothermia has been used in cardiac surgery for many years for neuroprotection. Mild hypothermia (MH) [body temperature (BT) kept at 32-35 °C] has been shown to reduce both mortality and poor neurological status in patients undergoing cardiopulmonary resuscitation (CPR). We sought to determine whether patients who were expected to benefit neurologically from therapeutic hypothermia (TH) would also experience favorable cardiac function.

Methods: The study was conducted between September 17, 2012 and September 20, 2013 with 30 patients who developed cardiac arrest (CA) in the hospital and acquired return of spontaneous circulation (ROSC) following successful CPR. Patient BTs were cooled to 33°C using intravascular heat change. Basal BT, systolic artery pressure (SAP), diastolic artery pressure (DAP), mean arterial pressure (MAP), heart rate (HR), central venous pressure (CVP), cardiac output (CO), cardiac index (CI), global end-diastolic volume index (GEDI), extravascular lung water index (ELWI) and systemic vascular resistance index (SVRI) were measured at 36°C, 35°C, 34°C and 33°C during cooling. BT was held at 33°C for 24 hours prior to rewarming. Rewarming was conducted at a pace of 0.25°C/hr. During rewarming, measurements were repeated at 33°C, 34°C, 35°C and 36°C. A final measurement was performed once patients spontaneously returned to basal BT. We compared cooling and rewarming cardiac measurements taken at the same BTs.

Results: SAP values during rewarming (34°C, 35°C and 36 °C) were lower compared to cooling (p<0.05). DAP values during rewarming (basal temperature, 34°C, 35°C and 36 °C) were lower compared to cooling. MAP values during rewarming (34°C, 35°C and 36°C) were lower compared to cooling (p<0.05). CO and CI values were higher during rewarming compared to cooling. GEDI and ELWI did not differ during cooling and rewarming. SVRI
values during rewarming (34°C, 35°C, 36°C and basal temperature) were lower compared to cooling ($p<0.05$).

Conclusions: To our knowledge, this is the first study comparing cardiac function at the same BTs during cooling and rewarming. In patients experiencing ROSC following CPR, TH may improve cardiac function and promote favorable neurological outcomes.

**Key words:** cardiac arrest, therapeutic hypothermia, cardiac function, cardioprotection, cardiac measurement