New Thermoregulatory System Maintains Normothermia During Pediatric Liver Transplantation

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Presented at IPTA, Rio 2003

Background

Maintaining normothermia during liver transplantation is challenging, and is especially difficult in young children. Various techniques have employed in attempt to prevent hypothermia, including elevated operating theater temperature, warm I.V fluids, warming mattresses or convective air systems. However these methods have a limited effect in maintaining normothermia in these operations. We had previously evaluated a novel microprocessor controlled body temperature regulation system (Allon™)(Fig.4) for various major surgical procedures in our hospital, and found it safe and very effective. Thus it seemed sound to apply this device to this challenging procedure.

Purpose

To evaluate the efficacy and safety of the Allon™ thermoregulatory system in liver transplant surgery in children.

Methods

The Allon™ system consists of three parts (Fig. 1): an algorithm driven heat pump that supplies warmed or cooled water to the ThermoWrap™ garment worn by the patient. The water temperature is determined as a function of the actual patient temperature and physician set point (30^{0}C-40^{0}C). Core and peripheral temperature sensors provide continuous feedback to the central unit in order to regulate the heat pump and thereby the patient temperature.

Fig.1

Fig.2

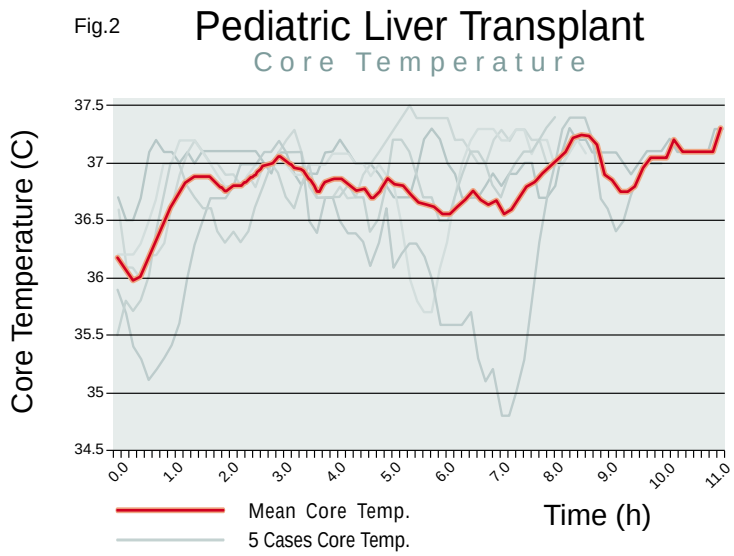
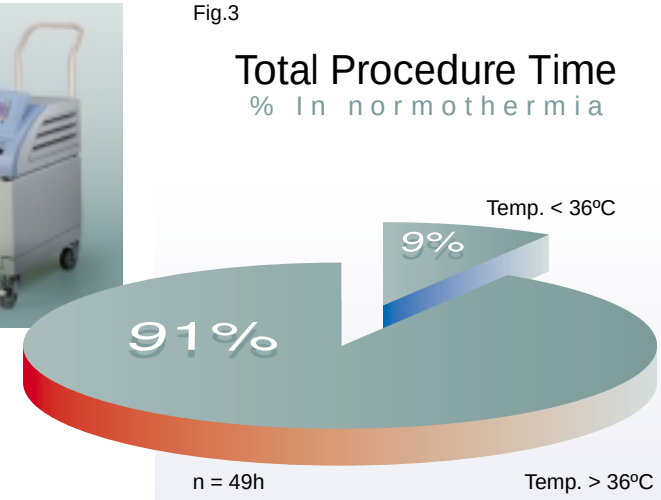


Fig.4

Fig.3



Patients

We used the Allon™ system in five consecutive cases of liver transplantation (two living related transplant and three cadaveric transplant) in children (ages 11 months, 3, 4, 5 and 9 years). The system was activated at the beginning of the surgery and was used uninterruptedly during the procedures. Operating room temperature was kept at 21^{0}C in all cases. Intravenous fluids and blood products were not warmed. The anesthetic team did not take any action in connection with temperature regulation other than applying the ThermoWrap™ and activating the Allon™ system at the beginning of the procedure. A computer, connected to the system recorded core (rectal) and skin temperatures continuously.

Results

Length of surgery ranged from 8-12 hours (mean 9.4 hours). The mean core temperature was greater than or equal to 36.0^{0}C throughout the procedure (Fig.2) even during the unhepatic phase. After an initial warming interval, only one patient, core temperature fell below 36^{0}C for a period of 110 minutes. This occurred following the transfusion of 700 ml of cold blood. The average core temperature recorded was 36.8^{0}C and ranged between 34.8^{0}C and 37.5^{0}C. All patients survived the procedure and all liver allografts functioned well immediately. No adverse skin reactions or any other device-related complications were noted.

Conclusions

The Allon™ system proved to be superior over all other devices used by us in the past. The system maintained normothermia throughout these long and complex procedures (Fig.3). The device was safe and simple to use, and no other measures were needed to keep the patient warm. Due to the efficiency demonstrated in these cases, we have chosen to make this thermoregulation method our standard of care in pediatric liver transplants and major pediatric procedures.