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Letter to the editor

Perioperative management of a patient with severe cold agglutinin disease by using multimodal warming measures.

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Declarations

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

Author contributions

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- Letter to the Editor -

Cold agglutinin disease (CAD) is an autoimmune disease caused by higher titers of cold-reacting autoantibodies that cause red blood cell (RBC) agglutination and subsequent hemolysis at the low temperatures often seen in the blood [1]. In patients with CAD, exposure to cold often causes RBC agglutination and subsequent hemolysis, which can lead to hemoglobinuria and critical complications such as renal failure and myocardial damage [1]. Therefore, the prevention of perioperative hypothermia is crucial in these patients undergoing surgery. Herein, we report the successful perioperative management of a patient with severe CAD by using multimodal warming measures as described below. Written informed consent was obtained from the patient for publication of this case report.

A 63-year-old man who had been diagnosed with CAD for two years because of repeated clinical symptoms with high titers of cold agglutinin (1:8192) measured at ambient temperature was scheduled to undergo lumbar laminectomy for lumbar canal stenosis. Despite being on daily medication with prednisolone 10 mg, he often experienced hemoglobinuria and acrocyanosis of the
distal extremities upon exposure to cold even in summer. On the day of the surgery, to prevent perioperative hypothermia, the infusion of amino acid warmed at 41°C with HOTLINE® Warmer (Smiths Medical Japan Ltd., Japan) was commenced 3 h before surgery. Additionally, skin-surface warming with an electric heating blanket was also commenced 30 min before surgery. Furthermore, the operating room was pre-warmed to 26°C. In the operating room, after induction of anesthesia, a temperature probe was inserted into the esophagus immediately before orotracheal intubation. Following intubation, the patient was placed in a prone position, and forced-air warming devices (EQUATOR®, Smiths Medical Japan Ltd., Japan) set at 37°C to 40°C were immediately applied to his upper and lower body. His anterior skin surfaces were also warmed by a circulating-water mattress. Furthermore, both his hands and feet were covered with gloves and socks, respectively. Immediately before skin incision, 100 mg hydrocortisone was administered intravenously for steroid cover. During surgery, intravenous infusion of amino acid warmed at 41°C was also continued. Surgical irrigation solutions were also pre-warmed to approximately 40°C. Fig. 1 shows the intraoperative trends of the core (esophagus) and peripheral (palm) temperatures. The patient was warmed continuously with an electric heating blanket and warmed amino acid infusions for approximately 24 h after surgery. The postoperative course was uneventful without any evidence of hemolysis.

In patients with CAD, when the blood cools below a critical temperature, often ranging from
30ºC to 37 ºC, which is called the thermal threshold, antibodies cause RBC agglutination and complement fixation. Thus, it is extremely crucial to maintain the core temperature and further prevent heat transfer from the core to the peripheries in these patients. Considering that the patient’s normal temperature was around 36.5ºC in the present case, to ensure the safety margin, we aimed to maintain both the core and peripheral temperatures at approximately 37.0ºC using multimodal warming measures such as pre-operative warming [2], intraoperative forced-air warming [1], administration of pre-warmed intravenous fluids [3], and infusion of amino acid [3], which have been reported to prevent perioperative hypothermia effectively. For example, Young and Haldane [4] described the efficacy of intraoperative forced-air warming and administration of pre-warmed intravenous fluids in the management of a patient with CAD. In the present case, in addition to the conventional strategies they used [4], we applied two more effective measures, pre-operative skin-surface warming [2] and perioperative warmed amino acid infusion [3] in ensuring the safety margin because the patient’s CAD was clinically severe. As shown in Fig. 1, it appeared that while pre-warmed amino acid infusions mainly contributed to the maintenance of the core temperature, skin-surface warming helped maintain both the core and peripheral temperatures by avoiding heat transfer from the core to the peripheries because of raised peripheral temperatures. Intraoperative amino acid infusions enhanced thermogenic effects and prevented hypothermia effectively during general anesthesia [5]. However, amino acid infusions started after the
development of core hypothermia failed to accelerate rewarming [5]. Accordingly, for the prevention of hypothermia, amino acid should be administered before the development of core hypothermia. That is, the prophylactic administration of amino acid should be considered in such severe cases where core hypothermia must be avoided. In the present case, the infusions of the amino acid were pre-warmed at 41°C. Previous report [3] described that administration of amino acid heated to 40 - 42°C reduced the incidence of intraoperative hypothermia safely. Therefore, we considered that the administration of amino acid warmed at 41°C could safely and effectively prevent intraoperative hypothermia in the present case. Surgical irrigation solutions pre-warmed to approximately 40°C were also used in the present case because these solutions warmed to 39 °C were safely used in preventing intraoperative hypothermia in a previous report [1].

To date, this is the first report describing the efficacy of the combination of these four strategies for the prevention of perioperative hypothermia in patients with severe CAD. The most striking difference between the present case and previous reports [1-3] is that warmed amino acid infusion and other preventive measures were simultaneously applied in our severe case. In the present case, we successfully maintained the core temperature and further avoided heat transfer from the core to the peripheries perioperatively by using these multimodal warming measures. In conclusion, in the management of patients with severe CAD, multimodal warming measures from various viewpoints should be considered in maintaining the core temperature and avoiding the initial
thermal redistribution from the core to the peripheries by reducing the temperature gradient between the two regions.
References


Fig. 1. Changes in core (esophagus) and peripheral (palm) temperatures over time.