THE ANNALS OF THORACIC SURGERY

Ann Thorac Surg 2000;69:1933-1934

Case reports

Third-degree burns due to intraoperative use of a Bair Hugger warming device

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Abstract

We report the case of a 3-year-old boy who underwent correction of transposition of the great arteries who developed burns from use of a patient warming device. His repair had been delayed because he was from a developing country, and he was offered surgery as part of a humanitarian effort. Postoperatively he was noted to have second- and third-degree burns from use of a Bair Hugger (Augustine Medical, Eden Prairie, MN) warming system after cardiopulmonary bypass.

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Introduction

Patient warming devices are used in the operating room during cardiothoracic surgery. These systems are used to maintain body temperature or to rewarm patients. With use of these devices, outcomes are improved and complications are rare. We report a child who developed second- and third-degree burns from use of a Bair Hugger (Augustine Medical, Eden Prairie, MN) warming system after cardiopulmonary bypass.

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This patient was known to have transposition of the great arteries. Balloon atrial septostomy was performed when he was an infant. He was taking digoxin and furosemide for congestive heart failure. Before surgery, this 3-year-old boy was cachectic-appearing and would become diaphoretic and agitated with activity. On physical examination his height and weight were 12.5 kg and 83 cm, respectively, both below the fifth percentile for age. He was cyanotic and had digital clubbing. He had a grade III/VI systolic murmur and no hepatosplenomegaly.

He was accepted for rapid two-stage arterial switch as part of a humanitarian effort. Two weeks before complete repair, he had pulmonary artery banding and right innominate to right pulmonary artery shunt placement to optimize left ventricular function. An echocardiogram showed adequate contractility and appropriate increase in left ventricular mass.

Fourteen days later he underwent anatomic correction of his TGA with removal of the shunt and pulmonary artery band. The total bypass time was 192 minutes with an aortic cross clamp time of 85 minutes. After bypass he had significant intraoperative bleeding. This was corrected with 2 hours of controlled hypotension maintaining systolic blood pressures in the range of 60 to 70 mm Hg. He required packed red blood cells, fresh frozen plasma, platelets, and cryoprecipitate. A Bair Hugger warming system was turned on to the medium setting at the start of the rewarming period and was used until he left the operating room.

In the pediatric intensive care unit, he had mild postoperative cardiac dysfunction. Hemodynamics were maintained with epinephrine 0.04 $\mu g \cdot kg^{-1} \cdot min^{-1}$, dopamine 2 $\mu g \cdot kg^{-1} \cdot min^{-1}$, nitroprusside 2 $\mu g \cdot kg^{-1} \cdot min^{-1}$, and amrinone 1.8 $\mu g \cdot kg^{-1} \cdot min^{-1}$, which were weaned within 17 hours. He remained well perfused and nonacidotic, maintained adequate urine output, and was extubated 15 hours postoperatively.

On the first postoperative day he was noted to have a few small, regularly spaced blisters on his lower extremities (see Fig 1). Over the course of the day the lesions became more widely distributed but remained isolated to the lower extremities. Becaues of their regular spacing, which corresponded to the spacing of the warm air exit holes, the blisters were presumed secondary to the heating blanket used in the operating room. The lesions were small (5 to 10 mm) and well circumscribed, some partial and some full thickness. Antibiotic ointment was applied to the lesions. His cardiopulmonary status improved rapidly and he was discharged from the hospital on the fourth postoperative day. The blisters were completely healed in follow-up.

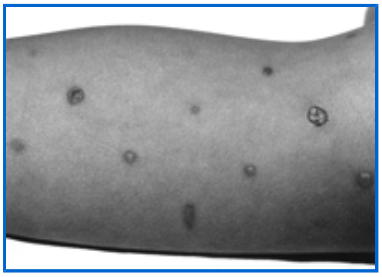

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Fig 1. Second and third-degree burns, 5 to 10 mm in diameter, on the lower extremity.

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The use of patient warming devices is common particularly during cardiothoracic surgery as a means of correcting induced hypothermia. The Bair Hugger warming system works by infusing heated air through a blanket and air escapes through small holes directed toward the patient. The system has three settings: low, medium, and high. Settings correspond to temperatures of 32.2°C ±2.8°C, 37.7°C ± 2.8°C, and 43.3°C ± 2.8°C, respectively.

The package insert indicates that the blankets should not be used during aortic cross-clamping, and patients with poor perfusion should not go without monitoring for prolonged periods of warming. The insert warns against use of the "high" setting in patients with low cardiac output, vascular disease, or poor or marginal cutaneous perfusion, and in immobilized patients. The company recommends monitoring temperature at least every 10 to 20 minutes.

Patient warming systems are beneficial in various clinical settings. Reversing hypothermia induced intraoperatively during cardiothoracic surgery with the Bair Hugger system has been reported to decrease the incidence of ischemia, atrial and ventricular fibrillation, and unstable angina [1]. Oxygen consumption was decreased with use of a Bair Hugger in children having spinal surgery [2]. Normothermic body temperatures led to a shorter duration of postoperative ventilatory support by 3 to 4 hours in adults after cardiac operations [3]. In addition, blood transfusions were reduced in patients having total hip arthroplasty [4].

Although complications are rare, problems can occur with use and misuse of the system. Thermal softening of endotracheal tubes has been reported with use of the Bair Hugger warming device [5]. According to the manufacturer, first-degree burns, but not second- or third-degree burns, have been reported.

Several factors led to second- and third-degree burns in our patient. This child was chronically cyanotic, with poor tissue perfusion as a consequence of his delayed cardiac repair. His intraoperative bleeding may have contributed to skin hypoperfusion. Postoperatively he did require pressors, but these potentially vasoconsticting agents were always used in low doses and were weaned off rapidly. These factors may have contributed to acute and chronic skin hypoperfusion and predisposed him to burns.

The Bair Hugger system is highly effective at reversing intraoperative hypothermia. Although there are potential complications associated with rewarming, the benefits clearly outweigh the risks. Cyanosis, hypoperfusion, or vasoconstricting medications may predispose to cutaneous thermal injury. The second- and third-degree burns seen in this patient should not preclude the judicious use of patient warming devices. This complication can probably be prevented with placement of an additional blanket between the patient's skin and the warming device.

Acknowledgments

The authors are grateful to Grace Caputo, MD, Residency Director, Phoenix Children's Hospital, Maricopa Medical Center Pediatric Residency Program, Phoenix, Arizona, for her considerate review of this case report.

We thank Augustine Medical for paying for the initial slides taken of this patient's burns.

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Accepted for publication October 21, 1999.

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