



WAKE UP SAFE®

The Pediatric Anesthesia Quality Improvement Initiative

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Over the past year, four cases reported to Wake Up Safe involved patients who had significant cardiovascular changes during intraoperative, large-volume, red cell transfusion. Review of these cases led to a decision of the Wake Up Safe leadership committee to issue an advisory to the pediatric anesthesiology community.

In three of the four cases reported, cardiac arrest occurred that was temporally related to rapid transfusion for acute surgical bleeding. Hyperkalemia was documented in those three patients. In two of the patients, serum potassium levels exceeded 8 mmol/L during transfusion of red cells that were 28 days and 23 days old; in the third patient, serum potassium exceeded 6 mmol/L after transfusion of red cells that were 5 days old. In all four cases, the transfused blood was irradiated on the day of use. The case profiles were as follows: an infant undergoing myelomeningocele repair; an infant undergoing resection of an abdominal tumor; a premature infant for resection of sacrococcygeal teratoma; and an infant with craniosynostosis for sagittal synoectomy.

Since the 1970s, there have been 11 case reports of transfusion-associated hyperkalemia in children; four of those 11 cases resulted in death. Infants seem to be at greatest risk—of the 11 case reports examined, eight described children less than 1 year old, and six of those eight infants were less than 6 months old. In addition, between 1998 and 2004, the Pediatric Perioperative Cardiac Arrest (POCA) registry received reports of eight cases of patients who developed hyperkalemic cardiac arrest related to blood transfusion.

Recommendations for Red Cell Products

Based on the cases reported to Wake Up Safe and a review of existing literature, Wake Up Safe recommends the following:

1. Transfusion with “fresh” red cell products (<7 days from collection) in cases where **massive transfusion** is anticipated. Teamwork with the Blood Bank is an important component of this endeavor.
2. If **irradiation** of the red cell product is indicated, transfuse the irradiated blood as soon as possible after irradiation. Irradiation increases the serum potassium level of the product, an effect that is compounded with increased storage time.
3. If red cell products with relatively high potassium levels are the only readily available option, several measures may be taken to reduce the chances of transfusion-associated hyperkalemia:
 - **Avoid a hypovolemia-associated low cardiac output state**, because this reduces the body’s ability to redistribute the extracellular potassium load and may result in an elevated serum potassium. Anticipate and replace blood loss early, before large hemodynamic changes occur.
 - Request the Blood Bank to **wash the red blood cell products**. Alternatively, a Cell Saver can be used to wash the red cells to reduce potassium levels. This option is institution dependent.
 - Transfuse blood **slowly**, if possible, through **> 23 gauge peripheral IV** rather than via a central venous catheter.

Wake up Safe, a component of The Society for Pediatric Anesthesia

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- **Check serum electrolytes frequently** during massive transfusion to treat changes before they become clinically significant.

Treatment of Hyperkalemia

- Dextrose: 1-2 G/Kg IV. Use 10% Dextrose in neonates; 25% Dextrose in older children.
- Insulin: 0.1 Units/Kg
- Calcium chloride: 10-20 mg/Kg (MAX 1 gram) or Calcium Gluconate: 30-100 mg/Kg (MAX 3 grams)
- Kayexalate: 1-2 G/Kg/dose via NG tube or per rectum.

References

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