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Perioperative problems in pediatrics

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The preoperative and postoperative care of the infant and child presents many unique management problems which differ significantly from those seen in the adult. These will be dealt with in this presentation by focusing on the following areas: monitoring, fluid and electrolyte management, respiratory support, surgical infection, and nutritional support. In addition, some unique aspects of trauma management will be discussed.

Monitoring

Sophisticated monitoring techniques have recently become available even for the smallest premature infant. In addition to the obvious parameters to monitor in a critically ill infant and child, such as bodyweight, urine output and electrocardiogram, invasive monitoring such as intraarterial blood pressure, central venous pressure and thermodilution cardiac output should also be used in a sick infant and child in the intensive care unit. Vascular access for these techniques has become standardized. The two most common types of shock seen in infants, children and adults are hypovolemic and septic shock. In the newborn and infant, septic shock is far more common than hemorrhagic shock. The newborn's and infant's response is significantly different than that of the child and adult. For example, a neonate in profound shock will often respond with bradycardia rather than the typical tachycardia, which is seen in the adult. In additon, a neonate already normally has a low blood pressure, especially a premature neonate, so that the insult of shock often does not result in significant further reduction in blood pressure. The mainstay of therapy for both types of shock is infusion of crystalloid and colloid.

Fluids and electrolytes

Fluid and electrolyte management of neonates and infants requires a thorough uderstanding of the body fluid compartment changes that occur between intrauterine and extrauterine life. Total body water and extracellular fluid steadily decrease during the transition from intrauterine to extrauterine life and continue to decrease during the first two years of postnatal life.

Renal function is underdeveloped in the newborn and infant with glomerular filtration being about 25 percent of the adult level. Likewise, renal concentrating ability is significantly reduced in the premature and full-term infant so that the maximal urine concentration achieved is 500-600 mosm/kg.

Neonates are very susceptible to excessive losses of water through the skin because of the significant transepithelial water loss that occurs. The water loss is aggravated by overhead radiant heaters and phototherapy.

Ventilatory support

Respirator failure is manifested by either poor oxygenation (hypoxemia) or inadequate ventilation; occasionally, a combination of the two is present. Mild to moderate hypoxemia can be treated by increasing the concentration of inspired oxygen. If this is inadequate, the next step is to elevate the transpulmonary distending pressure. This can be accomplished by several means including continous positive airway pressure (CPAP), intermittent positive pressure breathing (IPPB), and continous positive pressure ventilation (CPPV) or mechanical ventilation.

High frequency ventilation has recently been introduced for neonates and infants because of its beneficial effect on venous return and barotrauma.

Surgical infections

Immediately after birth, bacterial colonization of

the newborn begins. This process begins with the skin and shortly thereafter involves the gastrointestinal tract. By ten days of age, a normal newborn has the common variety of aerobic and aneorbic bacteria in his gastrointestinal tract. The normal barriers to invasive infection are underdeveloped in the newborn. In addition, the normal host defense mechanisms are not fully developed at birth. Full immunocompetence is developed in the first few months of life.

Neonatal sepsis is a systemic bacterial infection occurring during the first month of life. The source of infection is usually unknown; however, blood stream invasion is always present. Meningitis develops in about 25 percent of the cases and the mortality is quite high, averaging about 50 percent.

Nutritional support

The sick infant in need of nutritional support represents a separate and frequently more complex therapeutic problem than his adult counterpart. In addition to the metabolic demands that a major illness or surgical operation may impose, special consideration must be given to the pediatric patient due to smaller body size, rapid growth, highly variable fluid requirements, and, in the newborn, the immaturity of certain organ systems. Because of poor nutritional reserve, the infant can develop significant protein-caloric malnutrition in a relatively short period of inadequate nutrition. In general, the nutritional requirements of the infant are much greater than those of the older child and adult.

Nutritional support should always be enteral unless the gastrointestinal tract cannot be utilized because of concurrent disease. In that case, parenteral nutrition should be instituted.

Trauma

While accidents are the third most common cause of death in all age groups, they are the most common cause of death in children between one and fifteen years of age. About 20 million injuries a year occur in children in the United States, resulting in 15.000 deaths and approximately 100.000 cases of permanent disability.

Although the general principles of trauma care are the same for children as for adults, there are several areas where significant differences exist. For example, a small amount of blood loss which may be insignificant in the adult, can result in hemodynamic change in the small child. The accident pattern itself is often different in children than in adults. For example, head trauma is far more common in children and accounts for most of the morbidity and mortality in this age group. The mechanisms of injury are also different. The child is often an unrestrained passenger in the car or is a pedestrian hit by a motor vehicle. Child abuse and birth trauma are unique to the pediatric age group.

A unique area of pediatric trauma management is the nonoperative treatment of blunt injuries to the liver and spleen.

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