Neonatal Pain

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Infants have the neuro-anatomic and neuro-endocrine capacity for perceiving pain. There are short-term and long-term effect of pain in children. For example, neonates who undergo many painful procedures in the ICN will have increased responses to pain during vaccination. Therefore neonatal pain must be assessed and treated. Anyone who has cared for a 26-week gestation neonate knows that they respond to pain. Premature neonates usually respond to tissue injury by specific behavior ,and by anatomic, hormonal, and metabolic signs of stress. However, these infants may not respond to painful stimuli. If the stimulus should be painful treat it as pain. Some patients have over 7000 painful procedures before they leave the NICU. They usually respond to pain by a heart rate increase, paleness, duskiness, cyanosis, splayed fingers and extended arms and legs, frantic movement or limpness, grimacing, eye aversion, and sighing. They demonstrate a stress response, including release of catecholamines, corticosteroids, growth hormone, and glucagon. Fat, protein, and carbohydrates are broken down. The positive side of stress is that it maintains arterial pressure, cardiac output, and tissue oxygen delivery.

During painful stimuli there is a difference in blood flow to the two hemispheres of the brain. The total flow to both sides of the brains of male infants is greater than that of female infants for unknown reasons. In the ICN males receive more narcotics and sedatives than females. Is the difference in medication administration due to female infants having less pain? This is not known. In animals repetitive inflammatory pain causes cortical cell death and NMDA receptor-mediated excitotoxicity. There are long-term changes in these animals when they reach adulthood. Interestingly, treatment of neonates with continuous infusion of narcotics does not reduce the incidence of CNS hemorrhage, periventricular leukomalacia, or death.

Neonates who undergo surgery, must be anesthetized. However, the anesthetic requirement of premature infants is less than that of term neonates and infants. Failure to provide adequate anesthesia results in a stress response and release of catecholamines, growth hormones, and cortisol. The concentrations of catecholamines, glucose, lactate and pyruvate in the blood increase. There are suggestive data that the incidence of ICH and of death is greater if premature infants are inadequately anesthetized.

Adequate anesthesia can be accomplished with large doses of narcotics, inhaled anesthetics, or a combination of both. It should be remembered that the elimination half-life of narcotics is much longer in neonates and that some of the breakdown products of narcotics have potent narcotic effects.

References:

- Grunau RE, et. al:: Long-term consequences of pain in human neonates. Semianrs in fetal and neonatal medicine. 11:268, 2006

- Anand KJS: Pain assessment in preterm neonates. Pediatrics 119:605, 2006

- Aranda JV, et al: Analgesia and sedation during mechanical ventilation in neonates. Clin Therapeutics 27:877, 2005