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Holliday segar formula

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Estimated normal maintenance requirements for fluid therapy can be calculated using the estimated caloric expenditure method, which considers the resting energy expenditure in healthy children. However, this value is different for children with an acute disease or after surgery. The Holliday-Segar nomogram is commonly used to estimate water loss and requirement, based on the energy expenditure of healthy children. According to this formula, total daily water requirement is approximately 100 ml/100kcal/day, meaning that for every 100 kcal burned, the patient utilizes 100 ml of fluid. The Holliday-Segar nomogram approximates daily fluid loss as follows: 100 ml/kg for the first 10 kg of weight, 50 ml/kg for the second 10 kg of weight, and 20 ml/kg for the remaining weight. This formula is often divided into hourly rates, leading to the "4-2-1" formula. Maintenance water requirements can be calculated using this formula. For example, a 17 kg child would require approximately 1020 ml (100 ml/kg x 10.2 kg) of fluid per day, while a 30 kg child would require approximately 1500 ml (50 ml/kg x 10 kg + 20 ml/kg x 20 kg). Additionally, fluid and electrolyte needs from basal metabolism must also be accounted for. Maintenance requirements are related to metabolic rate and affected by body temperature. Insensible losses account for about one third of total maintenance water. Fluid replacement can be achieved through simultaneous infusions, allowing for independent adjustments to replenish deficits and ongoing losses. Baseline estimates are influenced by factors like fever, hypothermia, and activity level. The traditional approach to calculating maintenance fluids is based on the Holliday-Segar formula, which recommends 3 mEq/100 kcal/24 hours of sodium and 2 mEq/100 kcal/24 hours of potassium. However, this may not account for individual variations. Hyponatremia can occur due to iatrogenic factors like volume-related ADH release or stimuli-related ADH release from stress, vomiting, dehydration, or hypoglycemia. This can lead to increased free water retention and potentially serious complications. To mitigate the risk of iatrogenic hyponatremia, some centers now use more isotonic fluids like 0.45% or 0.9% saline for maintenance in dehydrated children. Minute ventilation (MV) and calorific requirement (CR) are both functions of metabolic rate. This study aimed to develop a formula for calculating resting minute ventilation (MV) based on body weight (BW), applicable across all age groups. The researchers used the Holliday-Segar formula, which relates calorific requirement (CR) to BW, and combined it with MV values from the Radford nomogram. By plotting MV against CR for various BWs, a straight line was obtained, indicating a strong correlation between the two variables. The equation derived: MV (mL/min) = 47 × CR (kcal/h), can be used to estimate resting MV for individuals of all ages. Comparison of the mechanical ventilation (MV) derived from Radford nomogram and the corresponding cardiac rate (CR) from Holliday-Segar formula revealed a strong correlation, with a slope of 46.8 [Figure 1]. The analysis showed that resting MV has a strong relationship with CR over all ages, from birth to adulthood. A simple equation was found: MV (in mL/min) = 47 × CR (in kcal/h). This physiological basis for estimating resting MV from body weight (BW) eliminates the need for nomogram charts. The value obtained can be used for initial ventilatory settings in infants, children, and adults of all sizes. Additionally, normal resting cardiac output (CO) for BW can also be estimated from this equation, as CO nearly equals MV in the resting state to maintain a ventilation-to-perfusion ratio of 1. Further studies are needed to validate these findings. The Holliday-Segar formula is a widely used estimate of daily caloric requirements, particularly for pediatric patients. Developed in 1957 by Drs. Malcolm A. Holliday and William E. Segar, the formula calculates energy expenditure based on body weight. The formula is generally applicable to most cohorts but may not accurately estimate caloric requirements in patients with fever, hypothermia, or increased activity states. It can also only be applied to patients above 2 weeks of age. The formula continues to be recommended in current clinical practice guidelines from the American Academy of Pediatrics, American Society of Parenteral and Enternal Nutrition, and National Health Service.