

Hyponatraemia in children

Dilutional Hyponatraemia has been documented in otherwise healthy children following routine elective surgery. It occurs in often female children 3-10 years of age and is associated with "stress". Risk factors include; Hyponatraemia, dehydration (>7%), Stress; Nausea, pain, anxiety, certain drugs, disturbances of the Central Nervous System and Metabolic and Endocrine disorders.

A fluid for children recommended for many years as a standard is 0.18 NaCl in 4% Glucose. It contains 30 mmol/l of sodium which when administered at the calculated rate (4 mls/kg/hour for the first 10 kgs body weight) provides the daily requirement of sodium and glucose.

0.18 NaCl in 4% Glucose is **isotonic *in vitro*** ie has the same osmotic potential so will not cause fluid shifts within the body. However in the catabolic (sick) child the glucose is metabolised rapidly causing the fluid to become **hypotonic** thereby leading to massive fluid shifts. At the same time because of the loss of fluid from the circulation often combined with a degree of dehydration a potent anti-diuretic hormone (ADH) response causes the kidneys to retain water resulting in a low volume concentrated urine, high in sodium. This may be compounded by the administration of a "fluid challenge" to elicit an improved urinary output.

This is a "double whammy" excess free water is administered and excess free water is retained. Water is drawn across blood capillaries into the interstitial and intracellular spaces. The child will become "puffy" looking and of greater consequence the brain will swell with the shift of water, leading to seizures and herniation of the tentorium and death. Therefore to prevent hyponatraemia we must limit the free water component of intravenous fluids AND monitor urine output and serum chemistry.

Halberthal M et al studied 23 patients studied with acute hyponatraemia. All received hypotonic fluids (plasma Na⁺ < 140 mmol/l). 16 (70%) received excessive maintenance fluids (>50%). 13 (57%) were postoperative patients and 18 (78%) developed seizures. 5 (22%) Died (Brainstem death), 1 severe neurological deficit.