Fluids and body composition during anesthesia in children: a bioimpedance study

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Background

The assessment of body composition, total body fluid volume, intracellular volume and extracellular volume before and after anesthesia may be useful to define a better intraoperative fluid administration.

Methods

A whole body bioimpedance spectroscopy device (BCM, Fresenius Medical Care, Germany) was used to measure total body fluid volume, extracellular volume, intracellular volume and fluid overload or deficit. BCM-measurements were performed before and after general anesthesia in 100 unselected healthy (ASA ≤ 2) children and adolescents aged 0-16 years visiting the Pediatric Institute of Southern Switzerland for low-risk surgical procedures.

Results

In 100 children and adolescents aged 7.0 [4.8 – 11] years (median and interquartile range), the average total body water (TBW) increased perioperatively with a delta value of 182 [0 – 383] mL/m^2 from pre- to postoperatively, as well as the extracellular water content (ECW), which had an equivalent increase with a delta value of 169 [19 – 307] mL/m^2. The changes in TBW (r^2=0.05, p=0.02) and ECW (r^2=0.20, p<0.0001) correlates with the amount of fluids administered.

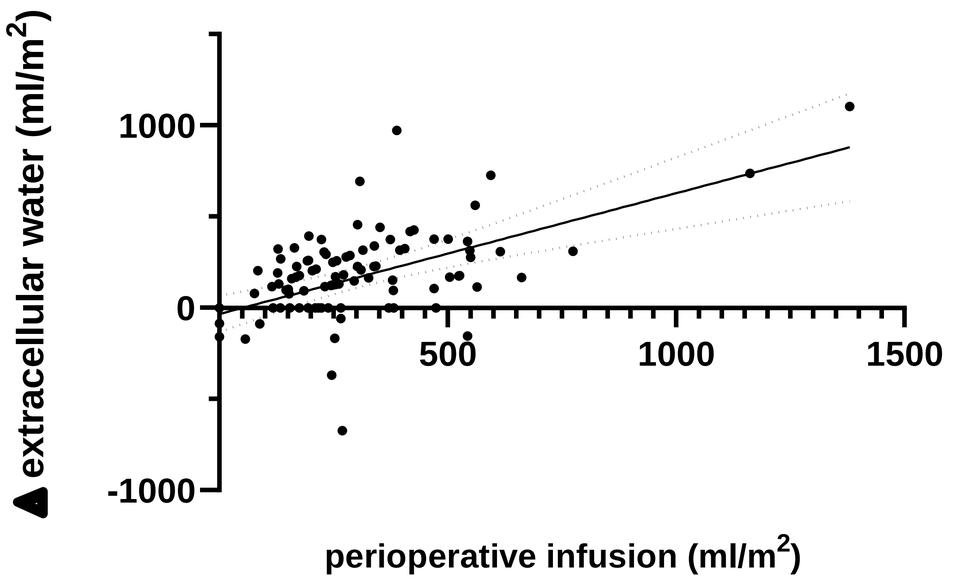

Figure 1: Linear correlation between fluids administered and perioperative changes in extracellular water content (ECW). The dotted lines represents the 95th confidence interval (r2=0.20, p<0.0001).

Discussion

The BCM serve as a simple non-invasive device for objective assessment of body fluid distribution in the perioperative setting.
During anesthesia and perioperative circumstances, the main goals are to avoid fluid deficits, ensure electrolytes homeostasis and achieve stability of vital parameters. The use of normal saline (or lactated Ringer) infusions does not increase the intracellular volume, yet provide an extracellular fluid volume expansion (figure 1). This tendency is more pronounced in lean compared to obese children (figure 2).

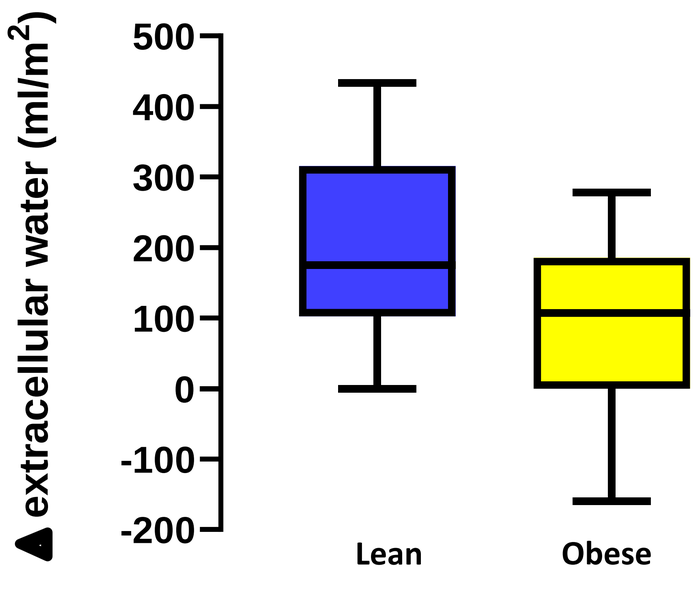

Figure 2: Perioperative changes in extracellular water content in lean (n=74) and obese (n=12) children. Box Plot represent median with interquartile changes with the 10th and 90th percentile (p=0.03)

Conclusions

- This analysis shows that the ECW expansion is directly correlated to the amount of fluid administered.
- Routine intraoperative fluid administration results in a significant fluid accumulation in low-risk schoolchildren during general anesthesia.
- Children and adolescents without major health problems (ASA ≤ 2) undergoing short procedures (< 1 hour), do not need any perioperative intravenous fluid therapy.
- BCM-measurements yielded plausible results in children and adolescents undergoing general anesthesia and could become useful for guiding intraoperative fluid therapy in future studies.

Bibliography

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