

Oral Triiodothyronine Supplementation Increases Lactate-pyruvate Ratio As a Marker of Effective Availability of Energy Substrates.

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Background: The incidence of euthyroid sick syndrome (ESS) was thought to be closely related to low cardiac output syndrome (LCOS) after congenital heart disease (CHD) surgery. Thyroid hormones exert their action on cardiovascular function by improving lactate and pyruvate utilization as effective energy substrates for mitochondrial respiratory function.

Objectives: To provide evidence that oral T3 can prevent and ameliorate ESS, thus subsequently reduce the incidence of LCOS, decrease serum lactate levels and lactate-pyruvate ratio as a marker of effective utilization of energy substrates.

Methods: The study was a single center, randomized, double blind, and controlled clinical trial. It was conducted in children, ≤ 3 years of age undergoing corrective open heart surgery. The treatment group received oral T3 supplementation 1 $\mu\text{g}/\text{kgBW}$ while the placebo group received saccharum lactis every 6 hours from the induction of anaesthesia until 60 hours after the first dose.

Results: A total of 171 participants were enrolled to the study. ESS was already found in 22.2% before surgery and in 89% at 24 hours post cross clamp removal (FT3 less than 2.5 pg/mL). LCOS was higher in the placebo than the treatment group with a significant difference at 6 hours post cross clamp removal (37% vs. 20% respectively, odds ratio of 2.28 (1.15-4.52), $p=0.02$). At 1 hour after cross clamp removal the serum lactate levels were significantly lower in the treatment group compared to placebo (1.50 (1.27 – 1.83) and 1.70 (1.55 – 2.23) mmol/L , respectively, $p=0.04$). There was an increase of lactate-pyruvate ratio at 1 hour post cross clamp removal in the treatment group without LCOS compared to those with LCOS [20.99 (15.82 – 31.56) vs. 12.61(8.89 – 18.67), respectively, $p= 0.04$] and in the placebo group at 24 hours post cross clamp removal [35.22 (22.08 – 65.75) vs.17.05 (11.84 – 26.07)], respectively, $p=0.01$).

Conclusion: Oral T3 prophylaxis could prevent and ameliorate ESS, which subsequently reduced LCOS after cardiac surgery. An increased lactate-pyruvate ratio in the treatment group may be a sign of an early increased pyruvate utilization for energy substrate.