

ABSTRACT

Surgical trauma results in a variety of physiological reactions in the body, including transient insulin resistance. The effect of surgery on postoperative wellbeing has been linked to this insulin resistance, which can be prevented through the ingestion of carbohydrate-rich liquid before surgery. The aim of this Thesis is to improve the clinical usefulness of the intravenous glucose tolerance test (IVGTT) by shortening the sampling time from 3 hours to 75 minutes and to use the IVGTT, and two other simple tests (QUICKI and HOMA-IR), to study whether most or all of the beneficial effects of the carbohydrate drink on postoperative insulin resistance can be explained by the water component of the drink.

Study I: Twenty healthy volunteers underwent a 75-min IVGTT. Insulin resistance was then assessed using the hyperinsulinemic glucose clamp technique, regarded as the gold-standard method. The resultant measurements of plasma glucose and insulin concentrations during the IVGTT were combined, using a variety of algorithms, allowing the insulin resistance, as measured by the clamp, to be predicted in 2/3 and 4/5 of subjects.

Study II: Sixty non-diabetic patients scheduled for hip replacement surgery were randomized into preoperative fasting (control), drink flavored water (placebo) or carbohydrate-rich liquid group. An IVGTT was performed the day before surgery, immediately afterwards, and the day after the surgery. No statistically significant differences were found with regard to glucose clearance, insulin resistance, postoperative complications or wellbeing between the three study groups.

Study III: A double-blind clinical trial was performed in which twenty-three non-diabetic patients underwent both an IVGTT and a hyperinsulinemic glucose clamp test on the day before and two days after hip replacement surgery. Half of the patients received a carbohydrate-rich liquid before the surgery; the other half received a placebo. There was a similar development of insulin resistance in both groups, but those who received a carbohydrate-rich liquid showed an increase in β -cell activity.

Study IV: Twenty-two patients from Study III were used to compare the insulin resistance results obtained from two dynamic tests (our short 7-sample IVGTT and the glucose clamp) and two static tests (QUICKI and HOMA-IR). The static tests showed slightly weaker linearity and larger residual errors compared to IVGTT in estimating insulin resistance before and after surgery. More importantly, they greatly underestimated the degree of surgery-induced insulin resistance, suggesting that they should not be used for that purpose.

Conclusions

The simplified IVGTT results strongly correlated with those obtained using the hyperinsulinemic glucose clamp technique, which makes its use possible in the clinical setting. There was no statistical difference in surgery-induced insulin resistance between those who had received a carbohydrate-rich beverage or flavored water prior to hip replacement surgery. In addition, similar outcomes were seen in patients who had received a pretreatment carbohydrate-rich beverage, water or fasted preoperatively with regard to well-being and complications. HOMA and QUICKI should not be used to assess surgery-induced changes in insulin resistance.

All previously published papers are reproduced with permission from the publishers.

Published by Karolinska Institutet. Printed by Larserics Print AB, Sundbyberg

© Stefan Ljunggren, 2013

ISBN 978-91-7549-216-2