A Pilot Randomized Controlled Study of Mild hypercapnia during cardiac surgery with cardiopulmonary bypass.

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ABSTRACT

Objectives

To test whether targeted therapeutic mild hypercapnia (TTMH) would attenuate cerebral oxygen desaturation as detected by near infrared spectroscopy (NIRS) occurs during cardiac surgery requiring cardiopulmonary bypass (CPB).

Design

Randomized controlled trials

Setting

Operating rooms and ICU of tertiary hospital

Participants

Thirty patients undergoing cardiac surgery with CPB

Interventions

Patients were randomized patients to receive either standard CO_2management (normocapnia) or TTMH (target PaCO2 between 50 and 55 mHg) throughout the intraoperative period and post-operatively until the onset of spontaneous ventilation.

Measurements and Main Results

We measured relevant biochemical and hemodynamic variables and monitored $SctO_2$ with NIRS. We followed up patients with neuropsychological testing. We compared patient demographics between groups using Fisher's exact and Mann-Whitney tests and compared cerebral tissue oxygen saturation between groups using repeated measures analysis of variance. The median patient age was 67 years (IQR – 62 years to 72 years) and the median EuroScore II was 1.1 (Table 1). The median CPB time was 106 minutes. The mean intra-operative $PaCO_2$ for each patient was significantly higher with TTMH (52.1 mmHg; IQR – 49.9 mmHg to 53.9 mmHg vs. 40.8 mmHg; IQR – 38.7 mmHg to 41.7 mmHg) ($p < 0.001$) as was pulmonary artery pressure (23.9 mmHg; IQR – 22.4 mmHg to 25.3 mmHg vs. 18.5 mmHg; IQR – 14.8 mmHg to 20.7 mmHg) ($p = 0.004$). There was no difference in mean percentage change in $SctO_2$ during

CPB in the control group for both hemispheres (left: -6.7% vs -2.3%, p = 0.110; right: -7.9% vs -1.0%, p = 0.120). Compliance with neuropsychological test protocols was poor. However, the proportion of patients with drops in test score greater than 20% was similar between groups in all tests.

Conclusions

TTMH did not appreciably increase SctO2 during CPB, but increased pulmonary artery pressures pre and post CPB. These findings do not support further investigation of TTMH as a means of improving SctO2 during and after cardiac surgery requiring CPB.