Evaluation of potential risk factors for prolonged periods of decreased cerebral tissue oxygen saturation after the Norwood procedure for Hypoplastic left heart syndrome.

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Objectives: Lower cerebral tissue oxygenation has been observed by near infrared spectroscopy during the early postoperative course after the Norwood procedure. We evaluated potential preoperative and postoperative risk factors for prolonged periods of decreased cerebral tissue oxygen saturation.

Methods: Cerebral (cSO2) and somatic (sSO2) tissue oxygen saturations and routine intensive care monitoring data were recorded from 68 HLHS patients for 24 hours before and 48 hours after the Norwood procedure. Average values of the last 4 preoperative hours (baseline) and of the first and last 4 postoperative hours (early and late course) were calculated. The absolute duration of cSO2 below 40% was evaluated and patients who had cSO2 values below 40% for 60 minutes or longer were classified to have sustained a prolonged period of decreased cSO2. Risk factors were evaluated with binary logistic regression and validated by bootstrapping.

Results: Baseline, early and late cSO2 values were 58 ±7%, 52 ±10% and 61 ±7%. Early postoperative values were significantly lower compared to baseline and later course (p<0.001). Postoperatively, cSO2 was <40% for 50 (0-1040) minutes. 32 patients had a cSO2 below 40% for ≥60 minutes. Preoperative cSO2 (OR 0.84 [0.74-0.94], p=0.004), age at operation (OR 1.44 [1.05-1.97], p=0.027) and postoperative diastolic blood pressure (OR 0.88 [0.78-0.99], p=0.038) were associated with a cSO2 <40% for ≥60 minutes in a logistic regression model. After validation by bootstrapping preoperative cSO2 (p=0.001) and postoperative diastolic blood pressure (p=0.023) remained in the model. A trend was observed for age at operation (p=0.056), but the mean cSO2 in the early postoperative course was lower in patients operated later than 4 days of life (49 ±11% vs. 55 ±8%, p=0.010). BT-shunt size, duration of cardiopulmonary bypass and selective cerebral perfusion were not associated with a cSO2 <40% for ≥60 minutes.

Conclusions: cSO2 during the early postoperative course of the Norwood procedure is lower compared to preoperative baseline. Older age at the Norwood procedure and a longer preoperative period of poorly balanced circulations, indicated by lower preoperative cSO2, may predispose to a more vulnerable cerebral vasculature and an increased risk for a more pronounced decrease of postoperative cSO2.