

Identification of preoperative and intraoperative predictors of regional cerebral oxygen desaturation during adult elective cardiac surgery

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Introduction

Previous studies indicated that regional cerebral oxygen desaturation is associated with worse major organ morbidity and mortality, postoperative cognitive dysfunction and increased hospital LOS in cardiac surgery (1-3). In a recent study, preoperative rSO₂ was directly related to body mass index, gender, and preoperative hematocrit (Hct), and was inversely related to age, creatinine, LVEF < 30%, and EuroSCORE (4).

Objective

To evaluate associations of preoperative characteristics and intraoperative factors to cerebral oxygen desaturation in adult cardiac surgery patients

Study Design and Subjects

- Prospective observational multicenter study in three clinical sites in the US: University of Minnesota, SUNY Upstate Medical Center, Minneapolis Heart Institute
- 90 adult patients undergoing elective cardiac surgery, aged ≥ 18 years old

Measurements

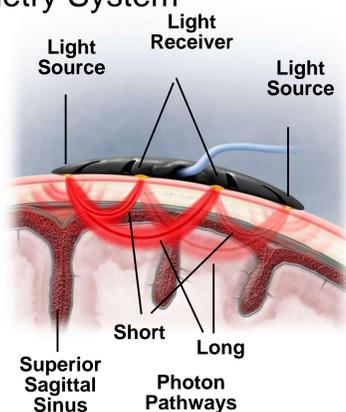
Preoperative characteristics: age, height, weight, BMI, gender, race, smoking status, prior surgeries, disease vessels, cerebrovascular disease, prior carotid surgery, dialysis and Hct.
 Intraoperative factors included lowest Hct, duration of surgery, duration and use of CPB.

- Univariate and multivariate linear and logistic regression analysis

rSO₂ Measurements

- Cerebral oximetry monitoring was conducted using the Nonin Model 7600 NIRS regional oximetry with 8000CA sensor
- Based on Equanox Regional Oximetry System
- Three wavelengths to improve accuracy
- Dual-emitter to eliminate surface effect
- Critical rSO₂ thresholds used:

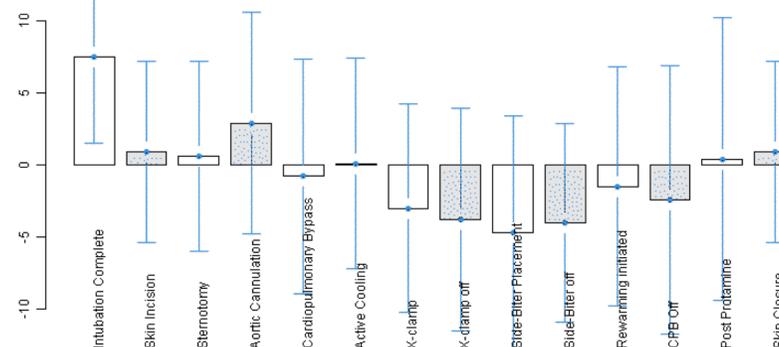
- 1) 25% below baseline
- 2) Below 50% absolute rSO₂
- 3) Nadir rSO₂



Results

Baseline characteristics	All sites (n=90)
Age (years)	61.6 ± 12.9
% Male	59/90 (65.6%)
Smoker	14/89 (15.7%)
Height (cm)	172.1 ± 10.3
Weight (kg)	91.3 ± 21.4
BMI	30.1 ± 7.2
Diabetes	33/90 (36.7%)
Redo	14/90 (25.6%)
On Pump	69/86 (80.2%)
Prior CVA	5/90 (5.6%)
Pre-op Dialysis	2/90 (2.2%)

Changes in rSO₂ from Baseline by Timepoint

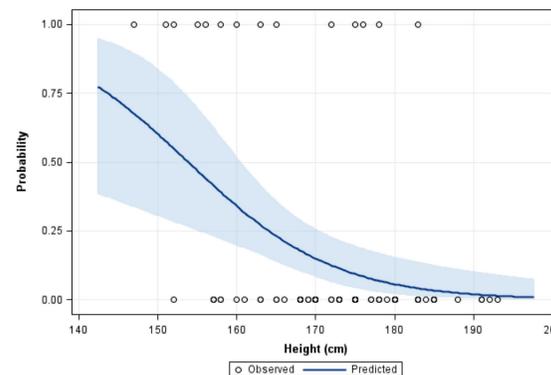


- 11% of subjects dropped ≥ 25% below the baseline
- 16.7% dropped below 50% rSO₂
- No associations with a 25% drop from baseline

Univariate predictors of dropping below 50% rSO₂

variable	OR	P-value	
Male	4.5	0.01	5/55 M, 9/29 F
Height (cm)	0.898 (1.1)*	0.002	1 cm increase
Weight (kg)	0.954 (1.05)*	0.009	1 kg increase
Preop Hct	0.860 (1.16)*	0.01	1 mg/dL increase
Lowest Hct	0.811 (1.23)*	0.04	1 mg/dL increase

* Denotes the ORs reported in the abstract which were expressed in reverse
Height was a significant predictor in the multivariate model



Univariate predictors of nadir rSO₂

variable	OR	P-value	
Age	-0.1288	0.02	1 yr increase
Height (cm)	0.2118	0.002	1 cm increase
Weight (kg)	0.0985	0.004	1 kg increase
Preop Hct	0.5802	<0.0001	1 mg/dL increase
Lowest Hct	0.4175	0.01	1 mg/dL increase
CPB duration	-0.2869	0.02	Each 10 min

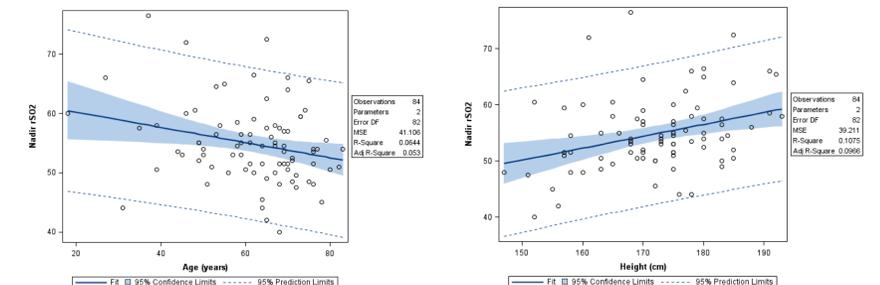
Nadir rSO₂ associations:

Nadir rSO₂ was inversely related (univariate) to:

- age, CPB duration

Nadir rSO₂ was directly related to:

- height, weight, pre-op hematocrit, lowest hematocrit, male gender and smoking
- Age (-0.12/year, p=0.01) and height (0.17/cm p=0.04) remained significant predictors in the multivariate model



Significance

- Factors that determine rSO₂ are cerebral blood flow, hemoglobin, SaO₂, PaCO₂, and cerebral O₂ consumption.
- Our data demonstrated that older and larger patients have paradoxically lower risk of cerebral oxygen desaturation
- Anemia is associated with lower nadir rSO₂ values
- This study supports the obesity paradox.
- This study will help us gain further insight into the nature of patient factors that might affect the variation in cerebral oxygen saturation, and patterns of desaturation.
- This will help us to trigger appropriate preventive measures aiming to improve perioperative cardiac outcome.

References

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Disclosures

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