

SCA60**Clinical Assessment of Cerebral Oximetry during Cardiovascular Surgery**

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INTRODUCTION: Cerebral oximetry monitors have been validated in strict laboratory conditions¹ Decreasing rSO₂ values can herald abnormal brain oxygenation and predict worse outcomes.^{2,3} However, it is not known what rSO₂ values represent normal or abnormal physiologic conditions. We studied rSO₂ in adult cardiac surgery patients at 3 sites.

MATERIALS AND METHODS: An IRB approved prospective, multicenter registry of a cerebral oximeter was done in elective on- and off-pump patients. Baseline (BL) demographics, medical history and risk factors were recorded. Bilateral oximetry sensors were recorded during surgery. No interventions were mandated. Summary statistics were generated across the sample. Registration rate was defined as percent of surgical time a reading was available. rSO₂ values were the average value of right and left channels. Predictors of decreased rSO₂ were sought using linear regression.

RESULTS: 90 consenting patients were enrolled and completed the study. Patient details are in Table 1. Electronic data was not captured in 6 patients. In the remaining 84 patients, rSO₂ readings were available for 96% of the time on at least one channel.

Mean BL rSO₂ was 63.9±8.8%. 5 patients had BL readings <50%; 25 had BL >60%. Univariate predictors of BL rSO₂ were BMI (p=0.05), weight (p=0.03), BL hematocrit (Hct, p<0.0001), BL creatinine (p=0.002), diabetes (p=0.01), and cerebrovascular disease (p=0.03). Diabetics had lower rSO₂ readings than non-diabetics (60.8±7.4% vs 65.8±9.2%). The only multivariate predictor of BL rSO₂ was preop Hct (1 mg/dl increase = 0.48% increase (p=0.008).

The average nadir rSO₂ was 54.9±6.6%; increasing age and on-pump surgery were related to lower values whereas increasing weight, height, hematocrit, male gender, smoking and baseline rSO₂ were related to higher values (univariate analysis). Table 2 shows the multivariate predictors. 13 of on-pump and 1 of off-pump patients dropped below an absolute value of 50% rSO₂. Multivariate predictors of dropping below 50% were height, weight and preop Hct (Table 2).

CONCLUSIONS: Our results represent "real life" rSO₂ values in cardiac surgery patients. BL rSO₂ values varied and were associated with preop characteristics. Lower nadir rSO₂ values were seen in on-pump patients. Cerebral oximetry is moving closer to defining "normal" or "abnormal" rSO₂ values, but larger population samples and more experience will be required to confidently define those values.

REFERENCES

1. Pollard, et al. *Anesth Analg* 1996;82:269.
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Table 2. Multivariate Predictors of Nadir rSO₂ and rSO₂ <50%

Parameter	Estimate	P-value
Nadir rSO ₂		
Age (year)	1 year increase = 0.09% decrease ¹	0.0361
Height (cm)	1 cm increase = 0.17% decrease ¹	0.0285
On pump	4.64% decrease ¹	0.0052
BL rSO ₂	1% increase = 0.29% increase ¹	0.0005
rSO ₂ < 50%		
Height	OR = 0.87 per 1 cm increase	0.0095
Weight	OR = 0.962 per 1 kg increase	0.0378
Pre-op Hct	OR = 0.853 per 1 mg/dL increase	0.0258
¹ Also adjusted for weight, pre-op hematocrit, smoking and male gender.		
² Also adjusted for gender		

Table 1. Demographic and baseline risk factors of enrolled patients

Age (years)	Mean ±SD [Range]	61.6 ± 12.9 [18, 83]
Male gender	n (%)	59/90 (65.6%)
Caucasian	n (%)	82/90 (91.1%)
Current smoker	n (%)	14/89 (15.7%)
Height (cm)	Mean ±SD [Range]	172 ±10.3 [147, 193]
Weight (kg)	Mean ±SD [Range]	91.3±21.4 [51, 144]
BMI	Mean ±SD [Range]	30.1 ± 7.2 [17, 57]
Prior cardiac surgery	n (%)	14/90 (15.5%)
Diabetes	n (%)	33/90 (36.7)
Cerebrovascular disease	n (%)	5/90 (5.6%)
Surgery performed off pump		17/90 (19.8%)
Type of surgery (n=90)		
Bypass grafts only		42/90 (46.7%)
Valve only		35/90 (38.9%)
Bypass grafts and valve		7/90 (7.8%)
Neither		6/90 (6.7%)
Hematocrit	Mean ±SD [Range]	
Pre-operative (n=90)		39.0 ± 5.5 [25.9, 49.9]
Post-operative (n=62)		32.2 ± 4.2 [25.1, 41.3]
Duration of surgery HH:MM (n=85)		4:59 ± 1:44 [1:23, 9:35]