SURVEY OF REGIONAL CEREBRAL OXYMETRY IN THORACIC AORTIC REPLACEMENT SURGERY:
COMPARISON OF NEAR-INFRARED CEREBRAL OXIMETERS

Misa Kajitani¹, Masahiro Morinaga¹, Wataru Takayama¹, Ryoichi Ochiai²

¹Kawasaki Saiwai Hospital, Dept of Anaesthesiology, Kanagawa, Japan, ²Toho University Omori Medical Center, Dept of Anaesthesiology

<Background and aims of study>

- ✓The incidence of cerebral infarction and neurological deficit following aortic surgery is reported to be 1-3% and 35% respectively¹.
- ✓The risk of cerebral ischemia is high especially in total arch replacement (TAR) with deep hypothermic circulatory arrest(DHCA)².
- ✓Near Infrared spectroscopy(NIRS) has been used in various clinical settings to evaluate cerebral regional oxygenation.
- ✓The difference among the NIRS machines has not been evaluated in such events as cerebral hypoperfusion during TAR, DHCA.

1. Lancet 2006;368:694-703
2. Ann Thorac Surg. 2007;84:759-66

<Objective>

Prospectively studied the changes in regional oxygen saturation(rSO₂; %) by INVOS™-4100(Somentics/Covidien, Inc, Mansfield, MA) <Picture1> and tissue oxygen index(TOI; %) by NIRO™-200X(Hamamatsu Photonics, Hamamatsu City, Japan) <Picture2> during retrograde cerebral perfusion(RCP)<Picture3> of DHCA and compared those parameters to evaluate the correlation between the two.

<Methods>

- ✓19 adult patients who underwent TAR
- ✓June to September 2016
- ✓Approval of institutional ethics committee and a written informed consent from each patient had been taken.
- ✓After induction of general anaesthesia, both sensors of INVOS and NIRO were placed on the forehead of the patients <Picture4>.
- ✓Recorded rSO₂ and TOI simultaneously.
- ✓Statistical analysis; Bland-Altman plot was used to compare the bias ±precision and polar plot analysis to evaluate trending ability of both devices. Demographic data<Table 1> are expressed as mean (±SD).

<Results>

- ✓A total of 558 pairs of data set were obtained(right 279 sets, left 279 sets).
- ✓The bias of right-side was -2.2%, left side was -1.8%.
- ✓Precision for right and left side was 6.3% and 9.0% respectively between NIRO and INVOS.
- ✓There was a correlation between the two devices; rSO₂ and TOI (r=0.54 for right, 0.83 for left, p<0.0001 respectively).
- ✓Concordance rate of right side and left side was as poor as 47.2% and 53.3%.

<Picture1>NIRO

<Picture2> INVOS

<Picture4>

<Table1>

Variables	
Number of patients	19
Weight(kg), mean (SD)	64(16)
Height(cm), mean(SD)	166(8.8)
Body Mass Index, mean(SD)	23(4)
Age(y), mean(SD)	71(9.5)
Male(%)	84
Pre CPB hematcrit(%), mean(SD)	36(5)
Temperature at arrest, tympanic(C°)	20.1(1.2)
Temperature at arrest, bladder(C°)	22.6(0.8)
DHCA(min), mean(SD)	65.7(17.6)
RCP(min), mean(SD)	6(1.76)

<Picture3>

RCP circuit

<Limitations>

- ✓Small sample sized study performed in a single center hospital
- ✓The present study was not objected to look at patient outcome
- ✓Direct comparison of two NIRS devices seemed to be difficult since the areas taken samples were close
- ✓How hemodilution and lower temperature during CPB affect NIRS detection is differ between the two devices

<Conclusion>

Cerebral regional oxygenation, which was monitored by NIRO and INVOS during DHCA, was evaluated and a correlation was found between rSO₂ and NIRO during RCP. However, concordance rate was poor between the two parameters. At the same ischemic event, two NIRS monitors tested in this study showed significantly different results. More specifically, the lack of trending ability between the two machines suggests that these two monitors might measure different parameters. It is clear that we need a standardization of near-infrared spectroscopy of tissue oxygenation.