The Effect of a Scalp Block on Surgical Plethysmographic Index(SPI) During a Mayfield Head Holder Insertion for Intracranial Surgery: a Randomized Controlled Trial

Sirivimol Punjasawadwong MD, Yodying Punjasawadwong MD, Ananchanok Saringcarinkul MD and Pathomporn Pin-on MD
Department of Anesthesiology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand, 50200

Introduction

SPI (Surgical pleth index™):

- ❖ A value ranging from 0-100, calculated from a formula¹
$$\text{SPI} = 100 - (0.33 \times \text{HBI} + 0.67 \times \text{PPGA}_{\text{norm}})^*$$
- ❖ A surrogate of autonomic stress responses to the surgical stimuli^{2,3,4}
- ❖ Negative correlation between SPI and high concentration of remifentanyl was demonstrated^{1,4}
- ❖ Few studies reported the effect of regional anesthesia on SPI responses to surgical stimuli⁵

In this study:

- ❖ We used head pin application for a Mayfield head holder insertion in neurosurgery as a surgical stimulation and scalp block as an anti-nociception
- ❖ This research focused on SPI in response to head pin insertion by comparing between patients with scalp block and those without scalp block
- ❖ We hypothesized that a scalp block could reduce a response of SPI from head pin application

* HBI = Heart rate beat interval, PPGA = Photoplethysmography from pulse oximetry

Methods and Materials

Prospective randomized controlled trial

Figure 1: A flow of the progress through the phases of a parallel randomized trial of the two groups

Inclusion criteria:

- ❖ ASA I-II
- ❖ General anesthesia
- ❖ Neurosurgery with head pin application

Exclusion criteria:

- ❖ BMI > 30, Skull defect
- ❖ Underlying diseases (DM, hypertension, ESRD, CAD, cardiac arrhythmias, and coagulopathy)
- ❖ Beta-blocker/ Calcium channel Blocker use

Results

Table 1: Surgical Pleth Index™ at each time point in both groups

SPI at each time point	Scalp block group (N=15)	No scalp block group (N=15)	P value
SPI before induction	54.0 ± 14.8	56.6 ± 12.74	0.23
after induction	23.9 ± 8.4	22.6 ± 8.5	0.67
at intubation	48.4 ± 14.1	47.4 ± 19.1	0.87
SPI 5 mins before head pin insertion	36.7 ± 6.72	33.8 ± 7.5	0.28
SPI 1 min after head pin insertion	49.1 ± 13.1*	61.8 ± 16.6*	0.028
2 mins after head pin insertion	55.6 ± 15.0*	67.6 ± 16.1*	0.045
3 mins after head pin insertion	56.4 ± 17.2	63.4 ± 18.3	0.22
4 mins after head pin insertion	50.8 ± 17.7	59.3 ± 20.9	0.24
5 mins after head pin insertion	46.5 ± 17.6	55.6 ± 19.2	0.19
6 mins after head pin insertion	45.1 ± 15.1	53.1 ± 16.2	0.17
7 mins after head pin insertion	45.9 ± 16.6	48.4 ± 16.7	0.68
8 mins after head pin insertion	44.8 ± 15.4	51.1 ± 14.8	0.26
9 mins after head pin insertion	41.6 ± 12.8	47.53 ± 18.0	0.31
10 mins after head pin insertion	39.5 ± 14.1	49.3 ± 17.6	0.10
SPI 1 min after surgical skin incision	46.2 ± 16.1*	65.6 ± 17.4*	0.003

SPI: Surgical Pleth Index™, * Statistical Significance, $P < 0.05$

Figure 2: Surgical Pleth Index™ (SPI) at each time point

Discussion

- ❖ Our preliminary results indicate the scalp block could reduce the response of SPI to head pin insertion to 16.5%
- ❖ We also have found that the SPI response occurs transiently to the maximal effect within 1-2 minutes and returns to the baseline within 10 minutes after the head pin insertion
- ❖ This finding is consistent with a previous study by Wennervirta et.al⁵ reporting the effect of interscalene plexus block on SPI responses

Conclusions

- ❖ SPI could be used to test the effectiveness of the scalp block on the response to an intense surgical stimulation such as the head pin insertion. However, its specificity could be confounded by other factors that could affect the autonomic nervous system

Contact

SIRIVIMOL PUNJASAWADWONG, MD
Maharaj Nakorn Chiang Mai Hospital, Department of
Anaesthesiology, Faculty of Medicine, Chiang Mai University,
Chiang Mai, Thailand, 50200
Email: sirivimol.p@cmu.ac.th Phone: (+66) 81-6032377

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