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LETTER TO THE EDITOR

Effects of indigo carmine intravenous injection on noninvasive and continuous total hemoglobin measurement with using the Revision L sensor

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Abstract The effects of intravenous injection of indigo carmine on noninvasive and continuous total hemoglobin (SpHb) measurement were retrospectively evaluated with the Revision L sensor. The subjects were 18 patients who underwent elective gynecologic surgery under general anesthesia. During surgery, 5 mL of 0.4 % indigo carmine was injected intravenously, and changes in SpHb concentrations between before and after the injection were evaluated. The mean age was 52.4 ± 12.8 years. Before injection, the median SpHb level was 10.1 (range, 6.8–13.4) g/dL. The results demonstrated no change in SpHb concentration between before and after indigo carmine injection as detected by the Revision L sensor. SpHb measurements as determined with the Revision L sensor were not affected, even after the intravenous injection of indigo carmine.

Keyword SpHb · Revision L · CO-oximetry · Indigo carmine

To the Editor:

The Radical-7 Pulse CO-Oximeter (software version 7805, Masimo Corp., Irvine, CA, USA) uses light at multiple wavelengths to continuously measure total hemoglobin (SpHb) concentrations, and has been reported to be useful in many reports [1–5]. Indigo carmine is rapidly excreted in the urine after intravenous injection and often used to confirm the presence or absence of ureteric injury during surgery. We retrospectively examined the effects of intravenous injection of indigo carmine on noninvasive and continuous total hemoglobin (SpHb) measurement with using the Revision L sensor.

Among patients who underwent elective gynecologic surgery under general anesthesia between May 2015 and October 2015, those who underwent SpHb monitoring with the Revision L sensor and who received an intravenous injection of 5 mL of 0.4 % indigo carmine during surgery were enrolled as subjects in the present study. The sensor was covered with a shield to prevent exposure to light and placed on any of the index, middle, or ring fingers contralateral to the inflatable cuff for noninvasive blood pressure monitoring. Indigo carmine was intravenously injected in the direction of the surgeon while bleeding was controlled. The anesthetics used in the present study were not fixed because of the retrospective study design. A combination of propofol and remifentanil or rocuronium was used for the induction of anesthesia, and propofol-remifentanil, sevoflurane, or desflurane-remifentanil was used for maintenance. The study variables were age, height, weight, SpHb levels before and after indigo carmine injection, and perfusion index (PI). Data acquired from the first 10 min after injection were analyzed. The SpHb level was considered to have decreased when it decreased by 10 % or more from the pre-injection level.

The present study was a retrospective in nature and conducted using medical records. This study was approved by the Ethics Committee at Fukushima Medical University. The requirement for informed consent was waived by the Ethics Committee. In place of obtaining informed consent from the patients, the study details have been disclosed on the website of Fukushima Medical University.

Eighteen patients were eligible. The mean age was 52.4 ± 12.8 years; the mean height was 156 ± 6.0 cm;

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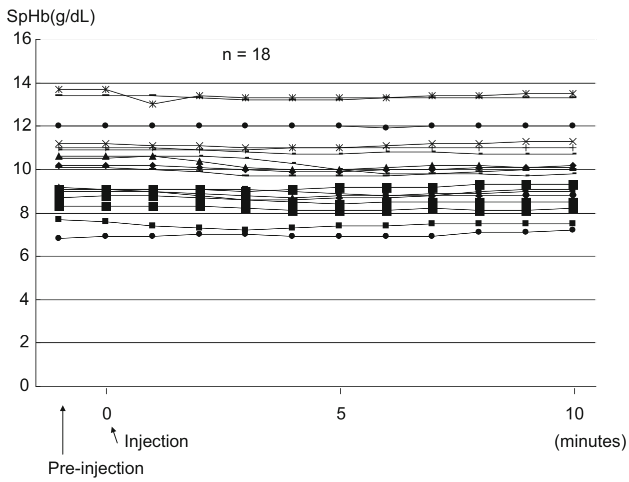

Fig. 1 Each patients individual SpHb values. No patient shows a decrease of 10 % or more from the pre-injection SpHb level after the intravenous injection of indigo carmine

and the mean weight was 57.9 ± 13.9 kg. Before injection, the median SpHb level was 10.1 (range, 6.8–13.4) g/dL, and the median PI was 3.65 (range, 1.7–5.71). After an intravenous injection of indigo carmine, no patient showed a decrease in SpHb concentration of 10 % or more from the pre-injection level (Fig. 1). Meanwhile, the pre-injection PI was 1.4 or higher in all patients, and the post-injection PI did not vary greatly from the pre-injection PI.

Associations between SpO_2 and dyes have been reported by Scheller et al. [6] in a study using a Nellcor™ pulse oximeter. They analyzed changes in SpO_2 by using three types of dyes, which were methylene blue, indocyanine green, and indigo carmine. As a result, although SpO_2 changed after the injection of all dyes, the number of cases with changes in SpO_2 was smallest among those who received an indigo carmine injection, and the extent of change was also small among these cases. In contrast, the extent of change in SpO_2 was greatest after the injection of methylene blue. Regarding the reason for this, Scheller et al. concluded that SpO_2 measurements as determined by the Nellcor™, which is a pulse oximeter that uses light at wavelengths of 660 and 925 nm for measurement, varied most greatly because the maximum absorbance of methylene blue is approximately 660 nm.

The Radical-7 Pulse CO-Oximeter uses light at multiple wavelengths and signal extraction technology using an advanced signal-processing algorithm and a unique adaptive filter to measure SpHb concentrations continuously. However, no wavelength used is disclosed.

As shown by the results of the present study, SpHb measurements as determined with the Revision L sensor were not affected, even after the intravenous injection of indigo carmine, and the sensor was found to be an extremely reliable monitoring device, even with indigo carmine use.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval The study protocol has been approved by the Ethics Committee at Fukushima Medical University.

Financial Disclosure The authors do not have a financial relationship with an organization.

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