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Letter to the Editor

To the Editor: Is the Serum Level of Reactive Oxygen Metabolites Appropriate for Evaluating Short-Term Surgical Stress of Patients Undergoing Colectomy?

To demonstrate whether reactive oxygen and free radical measuring are appropriate to evaluate short-term surgical stress after laparoscopic colectomy. The subjects consisted of 22 cases (laparoscopic surgery, 16; and laparotomy, 6) that underwent surgery for colon cancer. The reactive oxygen metabolites (ROM) value in the blood were measured perioperatively. The average ROM values immediately prior to surgery, immediately following surgery, and 1 day following surgery were 360.1, 316.0, and 346.7 U.CARR, respectively, meaning that ROM declined immediately following surgery compared with immediately prior to surgery ($P < 0.05$), while a tendency was observed for these values to increase again 1 day following surgery. In the comparison of pain control 1 day following surgery, a significantly lower value was indicated in the epidural anesthesia group (n = 12) compared with the fentanyl intravenous injection group (n = 10). Moreover, no significant change was observed in the surgical stress level in a comparison of patient background items such as age, sex, and so forth, laparoscopic surgery, and laparotomy. The low-invasiveness of laparoscopic surgery was not indicated in the ROM value 1 day following surgery, probably because pain control offsets the level of surgical stress using this method.

Key words: Reactive oxygen metabolites – Surgical stress – Colectomy – Laparoscopy

In recent years, advances have been made in low-invasive surgeries such as the introduction of laparoscopic surgery. Although the measurement of the serum interleukin 6 (IL-6) and HLA-DR expression on the monocytes has been used for objectively showing the low-invasiveness thereof, and oftentimes,[1] evaluations are carried out only using subjective elements such as the amount of analgesic drug used following surgery and the number of days in hospital. Recently, reactive oxygen and free-radical measuring instruments have been developed, allowing evaluation of the degree of oxidative stress in vivo. This oxidative stress is a state in which oxidative damage is caused to the living body and is said to be affected by invasion owing to surgical operations.[2] Howev-

Corresponding author: Susumu Eguchi, Department of Surgery, Nagasaki University Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki, 852-8501, Japan.
Tel.: +81 95 819 7316; Fax: +81 95 819 7319, E-mail: sueguchi@nagasaki-u.ac.jp

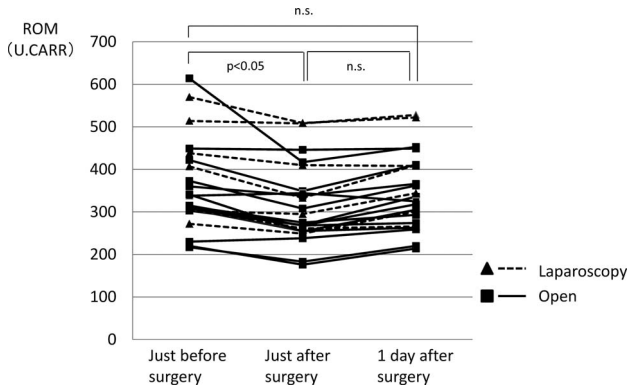

Fig. 1 Changes in ROM before and after colectomy.

er, no reports have been available to demonstrate whether reactive oxygen and free-radical measuring are appropriate to evaluate short-term surgical stress after laparoscopic colectomy.

Patients and Methods

We consecutively measured the level of reactive oxygen species in the serum of patients. The subjects comprised 22 patients who underwent surgery for colon cancer in our department from January 2009 to December 2009: 14 men and 8 women; 16 had laparoscopic surgery and 6 had laparotomy. Blood was sampled from patients immediately prior to commencing surgery after induction of anesthesia in the operating room, immediately following surgery in the operating room, and 1 day following surgery in the morning; the hydroperoxide (reactive oxygen metabolites: ROM) concentration in serum was measured using an oxidative stress measuring apparatus, the Free Radical Analytical System (FRAS4; Wismerll Co Ltd, Florence, Italy). Based on the results, an investigation was carried out regarding the relation between surgical stress (laparotomy versus laparoscopic surgery), postoperative pain control (epidural anesthesia group versus fentanyl intravenous injection group), and other elements. The operative procedures were selected based on the tumor location and stage and were performed by a single primary operator. The analgesia method was based on the trend of the favored pain control drug in our hospital. Statistical analysis was performed using nonparametric Mann-Whitney *U* test and 1-way analysis of variance (ANOVA).

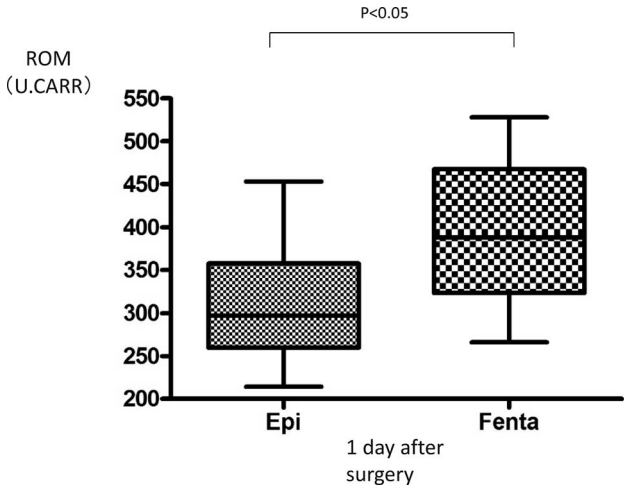

Fig. 2 ROM on postoperative day 1 under different analgesia. Epi, epidural analgesia; Fenta, fentanyl analgesia.

Results

The average ROM values immediately prior to surgery, immediately following surgery, and 1 day following surgery were 360.1, 316.0, and 346.7 U.CARR, respectively. The ROM value significantly declined immediately following surgery compared with immediately prior to surgery ($P < 0.05$), while a tendency was observed for these values to increase again 1 day following surgery (Fig. 1). In the comparison of pain control 1 day following surgery, a significantly lower value was indicated in the epidural anesthesia group ($n = 12$) compared with the fentanyl intravenous injection group ($n = 10$) (Fig. 2). Moreover, no significant change was observed in the surgical stress level in a comparison of patient background items such as age, sex, and so forth, laparoscopic surgery, and laparotomy.

Discussion

We evaluated the state of oxidative stress in vivo in an attempt to objectively evaluate the level of invasion in surgery for colon cancer. It was believed that oxidative stress increases following surgery owing to invasion from surgery; additionally, a tendency was observed of a significant decline immediately following surgery prior to anesthesia awareness, while increasing 1 day following surgery. Oxidative stress increases because of the loss in balance of oxidizability and antioxidative activity. Stimulation resulting from pain greatly affects oxidative stress, so it is believed that the oxidative

stress level declined during general anesthesia management owing to the antalgic effect thereof. According to the report by Kaneda *et al*,[3] anesthesia of a sufficient level has an anti-oxidative effect. A low ROM value was shown in the epidural anesthesia group regarding pain control 1 day following surgery, thus suggesting a difference in the analgesic effect. Meanwhile, according to the report by Pappas-Gogos *et al*,[4] with 8-isoprostane, 8-hydroxyguanosine, and 3-nitrotyrosine in serum measured as the index for oxidative stress, a lower value was observed in laparoscopic surgery compared with laparotomy upon a comparison carried out 24 hours following surgery for colon cancer.

In this study, FRAS4 was adopted as the apparatus for measuring the oxidative stress; however, the low-invasiveness of laparoscopic surgery was not indicated in the ROM value 1 day following surgery. As the reasons thereof, the fact that pain control following surgery was not standardized and the difference in the progression of cancer may be involved. Moreover, there are reports mentioning that age and sex are also related to oxidative stress,[5] and it is believed that the patient background is required to strictly carry out comparison to a certain degree.

Although FRAS4, which we adopted in this study, only requires approximately 30 minutes from blood collection to acquiring a result, and measurement may be very simply carried out, a significant declining tendency was shown in a stable state under general anesthesia management.

Fumihko Fujita, MD, PhD
Yasuhiro Torashima, MD, PhD
Mitsuhisa Takatsuki, MD, PhD
Tamotsu Kuroki, MD, PhD
Susumu Eguchi, MD, PhD
Department of Surgery, Nagasaki University
Graduate School of Biomedical Sciences,
1-7-1 Sakamoto, Nagasaki, 852-8501 Japan

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