EVALUATION OF THE VARIABILITY OF ANALGESIA/ NOCICEPTION INDEX VALUES IN DIGESTIVE SURGERY

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SUMMARY

Objectives: To evaluate the change of analgesia/nociception index values and average dose of sufentanil in surgery and to find out the relationship between analgesia/nociception index values and VAS score post-operation and its side effects. Subjects and methods: 60 patients, ASA I, II, aged 15 to 60 years undergoing digestive surgery were enrolled in the study. Participants were randomly divided into 2 groups. A standardized anesthetic regimen (sevoflurane, BIS monitoring, epidural analgesia maintenance with levobupivacaine 0.1% 5 mL/h, analgesia/nociception index monitoring) was utilized for both groups. Group 1 was received sufentanil under the guidance of analgesia/nociception index monitor (0.2 mcg/kg when analgesia/nociception index value < 50). Group 2 was received sufentanil 0.2 mcg/kg every hour. Results and conclusions: Analgesia/ nociception index values in the group 1 (58.7 ± 16.39) was 1.5 times lower than the group 2 (77.4 ± 12.29) with p < 0.001. Average dose of sufentanil in the analgesia/nociception index group patients (the group 1) (20.89 ± 5.75 µg) was statistically significant lower than the standard group patients (the group 2) (38.02 ± 15.55 µg). A good negative linear relationship between analgesia/nociception index score and VAS with r = -0,605 (r^2 = 0.366) was recorded. A reduced incidence of vomiting, nausea (analgesia/nociception index: 16.7% and standard: 33.3%) and slow breathing (analgesia/nociception index : 3.3% and standard: 13.3%) was observed.

** Keywords: Digestive surgery; Analgesia/nociception index value.*

INTRODUCTION

Digestive surgery is one of the most painful dissection. Acknowledging and evaluating the level of pain in peri-operation and post-operation is of great necessity. This helps us give accurately analgesics and avoid taking over-dose or inadequate dosage. It is difficult to evaluate the pain in unconscious patients. The clinical symptoms such as pulse, blood tension… are not specific and cause the wrong diagnosis.

The autonomic nervous system has two branches: The sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system is often considered the “fight or flight” while the parasympathetic nervous system is often considered “rest and digest” or “feed and breed” system. In many cases, both of these systems have “opposite” actions where one system activates a physiological response and the other inhibits. A patient without pain will have a dominant parasympathetic tone and vice verse. The sympathetic nervous system activates to make the change of heart beat and respiration. The analysis of respiratory sinus arrhythmia (RSA) is used to evaluate the pain-analgesia balance [2].

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Analgesia/nociception index (ANI) monitor (Metrodoloris France) has been launched since 2010. It is based on ECG data derived from two single-use ANI electrodes applied in V1 and V5 positions to the chest. The ANI is finally computed from a frequency domain-based analysis of the high frequency component (HF: 0.15 - 0.5 Hz) of heart rate variability (HRV) which also incorporates the respiration rate as a potential confounder [1]. ANI values range from 0 to 100. The pain occurrence makes ANI values decrease below 50 ANI value. From 50 to 70 is optimal pain relief. ANI value over 70 can show an over-dose.

In addition, ANI monitor is a noninvasive procedure and easy to use. Until now, there have been a lot of researches about ANI monitor in operation in some countries. However, in Vietnam, we have no research about this problem. We decided to conduct a study aiming:

To evaluate the variability of ANI values and average dose of sufentanil under the guidance of ANI monitor and some side effects in adult patients obtained digestive surgery.

SUBJECTS AND METHODS

Approval was obtained from the hospital's ethics committee and informed contents from each patient for the study.

The number "60 patients" was calculated by formula compare two mean values with the data according to the dose fentanyl bolus per hour in Upton Henry D's research in 2 groups: 1.3 ± 1.4 µg and 2.6 ± 1.6 µg [3].

60 patients aged between 15 and 60, ASA I, II undergoing digestive surgery in CASIC - Vietduc Hospital from 6 - 2017 to 9 - 2017 were included in the study. Patients with Glasgow score below 15, mental disorder, used pace-marker, shocked after operation, psychotic post-operation, not able to extubate, used atropine or catecholamine were excluded from the study.

We divided randomly the patients into 2 groups: Group 1 (ANI group) had 30 cases taken sufentanil under the guidance of ANI monitor (injected 0.2 µg/kg when ANI decrease below 50). Group 2 (standard group) included 30 patients who were taken sufentanil every hour 0.2 mcg/kg following standard practice. Two groups were started and maintained by the same anesthetic drugs. In operation, all of them were used epidural analgesia by levobupivacaine 0.1% 5 mL per hour and monitored by the same machines: ANI monitor, BIS, TOP Scan. Each group was taken sufentanil by two different ways as noted above.

All drugs would be stopped when closing skin happened. Patients were infused 1 g perfalgan and 20 mg nefopam in 30 minutes. To increase fresh gas flow (FGF) ≥ minute ventilation (MV) when finishing close skin. Epidural analgesia was maintained continuously. After extubating, patients were evaluated VAS score and ANI values at fifth, thirtieth, sixtieth, ninetieth, one hundred - twentieth minutes. The symptoms such as nausea, vomiting, low breath rate were assessed.

SPSS 22.0 was used to analyze our data and $p < 0.05$ is considered statistically significant difference. There are three kinds of criteria: common criteria, criteria in objective 1 and in objective 2. Age, sex, BMI, ASA, BIS values, time of surgery and time of general anesthesia were evaluated in common criteria. We analyzed ANI values in two groups, average dose of sufentanil in objective 1 and ANI values and VAS score, nausea, vomitting, low breath rate (< 10) in objective 2. Test Chi-square, Fisher's exact test, Phi and Cramer's, correlation coefficients Pearson were used to examine.

RESULTS AND DISCUSSION

Table 1: Characteristics of patients.

Characteristics		Group 1	Group 2	p
Sex (Male/female)	n (%)	20 (66.7)/10 (33.3)	16 (53.3)/14 (46.7)	0.292
ASA (I/II)		11(36.7)/19 (63.3)	12 (40)/18 (60)	0.791
Age (year)	$\overline{X}$ ± SD	46.13 ± 12.97	46.17 ± 12.25	0.992
BMI (kg/m^2)		20.58 ± 2.86	21.35 ± 3.42	0.353
BIS		48.35 ± 6.13	50.40 ± 5.62	0.182
Time of general anesthesia (minutes)		215.67 ± 61.47	232.67 ± 68.50	0.316
Time of surgery (minutes)		193.96 ± 57.86	203.33 ± 64.59	0.556

Table 1 shows the common criteria in two groups: Age, sex, BMI, ASA, BIS values, time of surgery and time of anesthesia. It is easy to recognize that there was no statisically significant difference between ANI group and standard group. All patients in our study had similar characters about physical characteristics and common parameters in an operation.

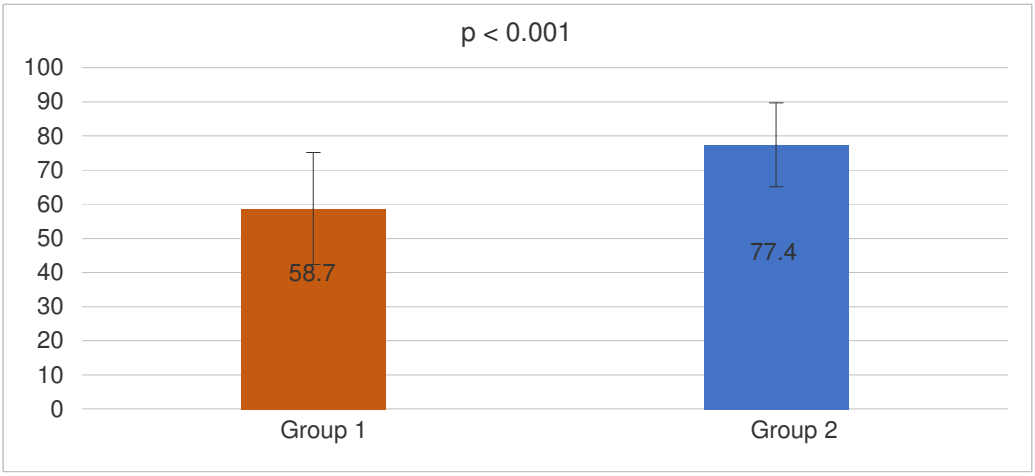

Figure 1: Variability of ANI values in 2 groups.

In the study, we recognized that the average values of ANI between group 1 (ANI group) and group 2 (standard group) differentiates significantly with $p < 0.001$. Therein, the average values of ANI group were 58.7 and that of standard group was 77.4 (*fig 1*). The dosage of sufentanil in standard group (38.2 ± 15.5) almost doubles that of group 1 (20.89 ± 5.75) with $p < 0.001$ (*fig 2*). The use of ANI monitor for the guidance of giving dose of sufentanil in group 1 made a reduction in the total sufentanil dose during the operation. This helps patients avoid drug overdose, reduce side effects caused by drugs and ensure pain relief adequately for the patient. Henry D. Upton et al conducted a study on fifty patients aged between 18 and 75 with spinal surgery showed that ANI group had 64% lower dose of fentanyl than control group [3].

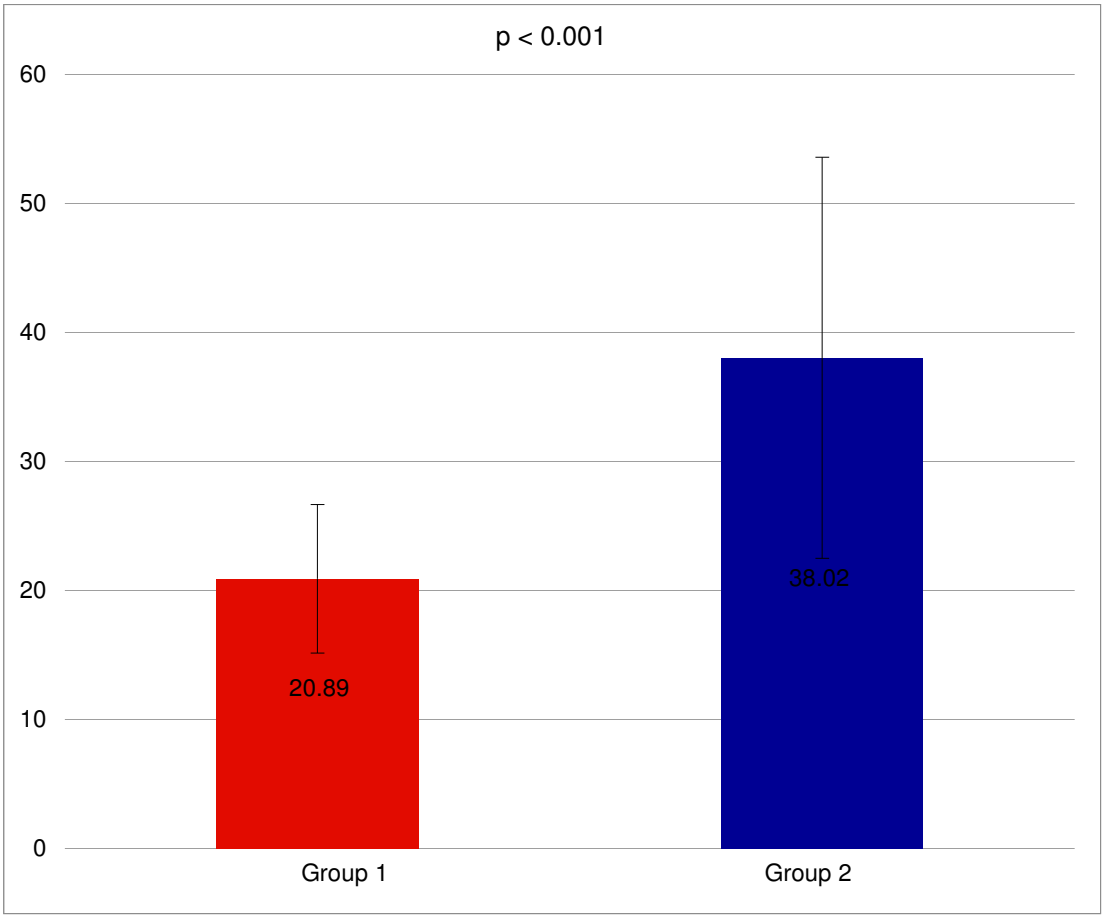

Figure 2: Average dose of sufentanil.

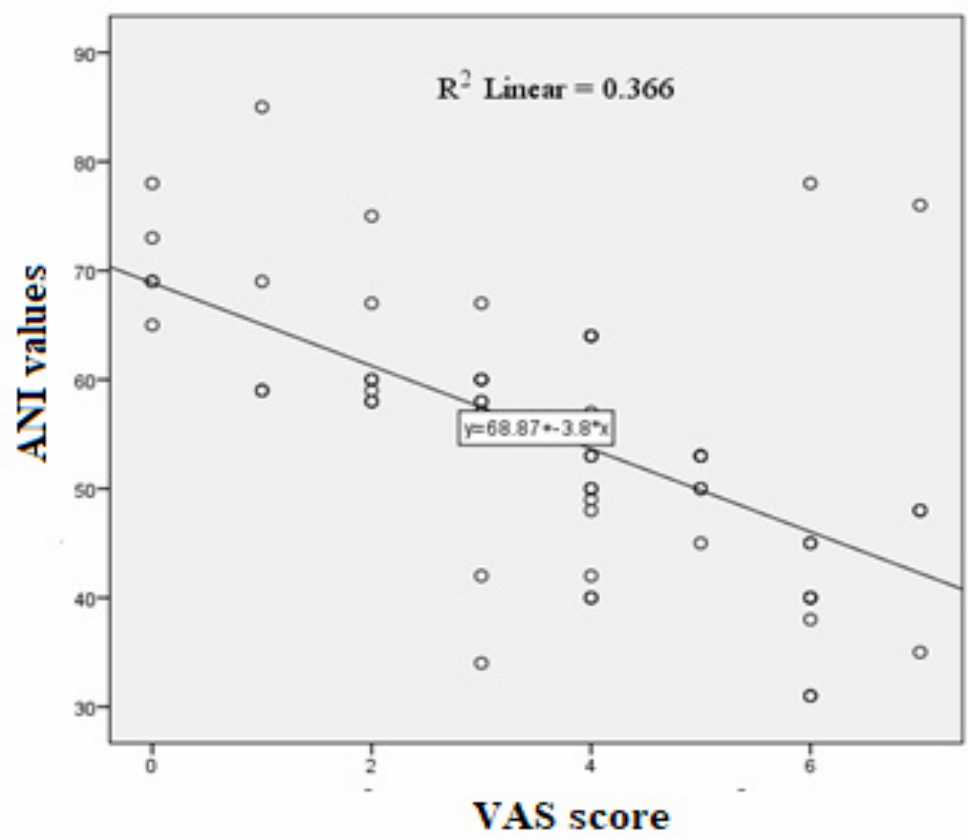

Figure 3: Correlation between ANI values and VAS score.

We found a good negative linear correlation between ANI values and VAS with r = -0.605 post-operation. ANI values decreased, so VAS score increased. VAS is considered "gold standard" for evaluating the pain level in conscious patients. ANI monitor should be used to assess the pain post-operation. E. Boselli's study (2013) on 200 patients post-operation also showed a negative linear relationship between ANI values and VAS (r^2 = 0.41) [1].

Table 2: The post-operative side effects.

Characteristics		Group 1	Group 2	p
Nausea and vomiting	n (%)	5 (16.7%)	10 (33.3%)	0.136
Bradypnea		1 (3.3%)	4 (13.3%)	0.161

The side effects after surgery such as nausea, vomiting, low breath rate (< 10) were not different between ANI group and standard group. However, we found a reduction of all side effects in ANI group.

CONCLUSION

60 patients ASA I, II, aged 15 - 60 obtained digestive surgery:

- The variability of ANI values and average dose of sufentanil:

+ ANI values in group under the guidance of ANI monitor ranged optimally (58.7 ± 16.39) while standard group had higher values (77.4 ± 12.29) with $p < 0.001$.

+ Average dose of sufentanil in ANI group was lower (20.89 ± 5.75) than standard group (38.02 ± 15.55) and the difference was statistically significant.

- Correlation between ANI values and VAS and some side effects:

+ There was a good negative correlation between ANI values and VAS with $r = -0.605$ ($r^2 = 0.366$).

+ Reduce incidence of nausea and vomiting (ANI: 16.7% and standard group 33.3%), reduce incidence of low breath rate (ANI 3.3% and standard group 13.3%).

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