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MONITORING OF PAIN IN HEMATOLOGICAL PATIENTS

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МОНИТОРИНГ БОЛИ У ГЕМАТОЛОГИЧЕСКИХ ПАЦИЕНТОВ

Цель: оценить методы мониторинга боли во время анестезии и реанимации у гематологических пациентов.

Материалы и методы: в проспективном, описательном одноцентровом исследовании были проанализированы различные методы оценки боли у гематологических пациентов с нарушенным сознанием, после общей анестезии и после спинальной анестезии. Индекс ноцицепции и аналгезии (ANI, MetroDoloris), вегетативный индекс (VI), сердечный ритм (HR), среднее артериальное давление (MAP), современные балльные оценки боли (числовая рейтинговая шкала для оценки интенсивности боли (NRS) и шкала комы и ноцицепции (NCS)).

Результаты: у коматозных пациентов и пациентов после общей анестезии реакции на стимулятор ноцицепции были сохранены и выявлены с помощью монитора ANI. Во время бронхоскопии и гастроскопии ANI снижался с исходного уровня от 90 до 20–30, во время укола при взятии крови ANI уменьшалось до 40, при вставке центрального катетера ANI — до 30. Диапазоны изменений ЧСС, MAP и VI соответствовали ANI, но эти изменения были незначительными и не были доступны для оценки боли у коматозных пациентов. У пациентов после спинальной анестезии данные ANI, за исключением того, что соответствуют восстановлению сенсорно-моторного блока, были чувствительны к боли. За час ANI уменьшилось с 52 до 38 до развития спинального блока. Эти данные были использованы для начала послеоперационной аналгезии. В то же время изменения HR, MAP и VI не были информативными.

Выводы: визуализация и объективация боли представляется возможной только путем комплексной оценки различных параметров: ANI, VI, гемодинамических параметров, современных шкал оценки боли. Использование ANI представляется наиболее информативным, однако эти данные требуют дальнейшего изучения.

Ключевые слова: боль, ANI, гематология.

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MONITORING OF PAIN IN HEMATOLOGICAL PATIENTS

Purpose: to evaluate the methods of pain monitoring during anesthesia and resuscitation in hematological patients.

Materials and methods: In a prospective, descriptive single center study various methods of pain assessment were evaluated in hematological patients with impaired consciousness, after general anesthesia and after spinal anesthesia. Index of nociception and analgesia (ANI, MetroDoloris), vegetative index (VI), heart rate (HR), mean arterial blood pressure (MAP), modern scale pain scores (Numeric Rating Scale (NRS) and Nociception Coma Scale, (NCS)) were evaluated.

Results: In comatose patients and patients after general anesthesia, the reactions to nociception stimulus were saved and revealed with ANI monitor. During bronchoscopy and gastroscopy, ANI decreased from baseline of 90 to 20-30, during pinprick for blood taking ANI decreased to 40, during central catheter insertion ANI decreased to 30. The ranges of the changes of HR, MAP and VI corresponded to ANI, but these changes were insignificant and not available to evaluate the pain in comatose patients. In patients after spinal anesthesia, ANI data, except that correspond to the restoration of sensory-motor block, were sensitive to pain. ANI decreased from 52 to 38 an hour before spinal block recourse. These data were used to start the postoperative analgesia. At the same time changes of HR, MAP and VI weren't informative.

Conclusions: Visualization and objectification pain seems possible only by means of a comprehensive assessment of various parameters: ANI, VI, hemodynamic parameters, modern pain assessment scales. The use of ANI is represented to the most informative; however these data demand further studying.

Key words: pain, ANI, hematology.

Introduction

Postoperative pain and nociceptive reaction unrecognized in patients with impaired consciousness, serious health and socio-ethical problems, first of all, the difficulty of the objective, long-term and continuous monitoring of pain. By definition, the International Association for the Study of Pain, pain — "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" [1]. Thus, the pain — it is a subjective sensation, therefore, visualization and objectification pain is very difficult.

The study of pain sensitivity in patients with diseases of the blood system is a complex and poorly lit problems. In hematology clinic there is the need to assess pain in patients in the perioperative period, with the aim of monitoring the correctness and adequacy of postoperative analgesia. Also very stung by unnoticed in terms of pain patients are in a coma. So far, no established criteria for assessing pain and not formulated clear indications for permanent or temporary pain relief in patients reanimation profile with suppression of consciousness. This disturbance of consciousness does not exclude the deterioration of nociception. Cases of recovery of patients, long-term comatose when assigning them pain medication [2]. The present study investigates the different techniques that can objectify pain.

Purpose: Diagnosis and monitoring of pain in patients anesthetic and resuscitation clinic hematological profile in different clinical situations.

Materials and Methods

The study is a prospective, descriptive, analytical. The work is designed and carried out in National Research Center for Hematology, Moscow, Russian Federation

in 2016. The study included patients anesthetic and resuscitation profile, are treated for hematological diseases. Along with common hemodynamic parameters (blood pressure, heart rate), able to indirectly indicate the presence of pain, studied the dynamics of nociception index and analgesia ANI (Analgesia Nociception Index), vegetative index (Vegetative Index, V.I.) or index Kerdo also made assessment of pain using modern scales: The ten-estimated rating scale NRS (Numeric Rating scale) for patients in the mind and the scale of nociception in patients in coma — NCS (nociception coma scale) [3]. With NCS scale (Nociception Coma Scale), response to pain is assessed using 4 indicators: motor, verbal, visual response, facial expression when exposed to painful stimuli [4].

The use of ANI and V.I. to determine the state of the autonomic nervous system, through which it is possible to evaluate the response to painful stimuli. ANI — a standardized measure of the parasympathetic component of the autonomic nervous system. ANI estimates and cross-sectional, and rapid change of tone induced by the respiratory cycle each RR (spontaneous or induced) to measure the "relative amount" tone. ANI Calculated values range from 0 to 100, depending on the level of parasympathetic activation. 100 is a high degree of parasympathetic modulation (low voltage level, the lack of sensitivity to pain), 0 means a very low degree of parasympathetic modulation [5]. In this study we used ANI monitor companies MDoloris. Installation and use of the device is carried out according to the instructions. Factors impairing interpretation ANI indicators (rhythm disorders, cardiac pacemaker, medicines, etc.) are excluded.

V.I. is an indicator used to evaluate the activity of the autonomic nervous system, which is based on the ratio of change in diastolic blood pressure and heart rate (Kerdo, 1953). Vegetative Index is calculated:

$$V.I. = 100 (1 – DBP / HR),$$

where DBP is diastolic blood pressure; HR — heart rate.

If vegetative index value greater than zero, the predominate excitatory influence in the activity of the autonomic nervous system (sympathicotonia). If less than zero, — the brake (parasympathicotony). If V.I. is zero, this indicates a functional balance [6].

Case 1

Patient P., 50 years old, was examined in the intensive care unit with a diagnosis of B-acute lymphoblastic leukemia, the first late relapse. Condition after chemotherapy for ALL program 2009.

The patient's condition was defined as severe. The severity of the condition due to acute respiratory failure on the background of bilateral lobar pneumonia requiring mechanical ventilation through a tracheostomy tube. Ventilator parameters: SIMV mode; respiration rate 12 min, PEEP 5, the FiO_2 of 35%. The level of consciousness of 10 points on the Glasgow coma scale (GCS). Contact with sick complicated, unfocused response to pain stimulus, opening an eye on it. On a scale of NCS: — 6 points (in response to a painful stimulus: flexion of the upper extremities, no sound response, eye movements, grimace). A marked weakness in the limbs, probably due to peripheral polyneuropathy. Febrile body temperature.

Thus, given the depression of consciousness and muscle weakness to determine the presence/absence of pain and its intensity is extremely difficult. The study also investigated the following parameters: HR, MAP (mean arterial blood pressure), V.I. As pos-

sible painful stimulus consiered standard routine procedure: bronchoscopy, blood samples (from a capillary), gastroscopy, suturing central catheter.

Results. In spite of the serious condition of the patient, baseline ANI higher that meets the predominance of parasympathetic tone. In carrying out various routine procedures, it found that the most severe pain reaction was seen to hold broncho and gastroscopy. According to ANI monitor marked decline from the baseline 90 to 20–30, which corresponds to the significant predominance of sympathetic tone. Hemodynamic response corresponded, but was less pronounced: there is an increase in heart rate of 10 bpm. per minute (from 130 beats per minute up to 140 beats per minute), mean arterial pressure increase 109 mmHg with up to 120 mm Hg. Procedures such as blood sampling from a capillary, suturing central catheter is also accompanied by a painful reaction, which is most clearly defined by means of ANI. When taking blood from a capillary ANI fell to 40, with catheter suturing to 30 (from a baseline 90). The hemodynamic response is also quite fair when taking blood from a capillary MAP — 113 mm Hg, with suturing catheter — 120 mm Hg, heart rate when taking the blood remained at the same level — 130 bpm cpm in suturing the catheter is only slightly increased to 134 bpm in a minute. Indicators V.I. changed also quite moderate.

Discussion. This case demonstrates the complexity of the assessment of pain in patients with impaired consciousness, relying only on standard hemodynamic parameters. Fever and a small range of changes in heart rate and blood pressure during various invasive procedures did not allow to correctly interpret the intensity of pain. Accelerated heart rate from 130 to 140 bpm per minute as possible to carry out the procedures MAP from 110 to 120 mm Hg maximum, thus practically did not differ at different traumatic impacts. Taking into account the fact that in the development of pain in humans the predominant influence of the sympathetic nervous system, V.I. been calculated at rest and during conventional invasive procedures. As shown in Fig. 1, in patient at rest and during procedures observed sympathicotonia (V.I. greater than 0), and the impact of the pain stimulus is captured using the V.I., but again barely noticeable (increasing from 31 till 32–37 at completion of the procedures).

Dynamics of indicators ANI, in contrast to the above parameters, more pronounced and informative. The rest ANI-90, which rejects the intense pain, then when performing invasive procedures, there is a marked reduction antinociceptive index to 20–40, which corresponds to the pain response. As shown previously, the reduction ANI indicators correlated with characteristic changes of hemodynamic parameters (increasing MAP, heart rate acceleration), V.I. (increased sympathetic tone).

Thus, patients in a coma for a reaction to pain stimulus is saved and is detected by monitoring the hemodynamic parameters, vegetative index, but is the most precise when using ANI. The findings suggest the need for early detection of pain in patients with impaired consciousness and appointment of adequate, timely analgesia.

Case 2

Patient B., 29 years old, diagnosed with Hemophilia A, a severe form with right knee arthropathy. In terms of combined endotracheal anesthesia performed surgery Total hip right knee. ASA II.

For the purpose of objectifying the needs for analgesics in the postoperative period was conducted controlled analgesia (PCA). PCA was performed using a programmable syringe pump, with the block for the PCA "Bbraun" with the following parameters: 2 mg bolus of morphine, lockout interval is 10 minutes. Pain was assessed on a scale NRS

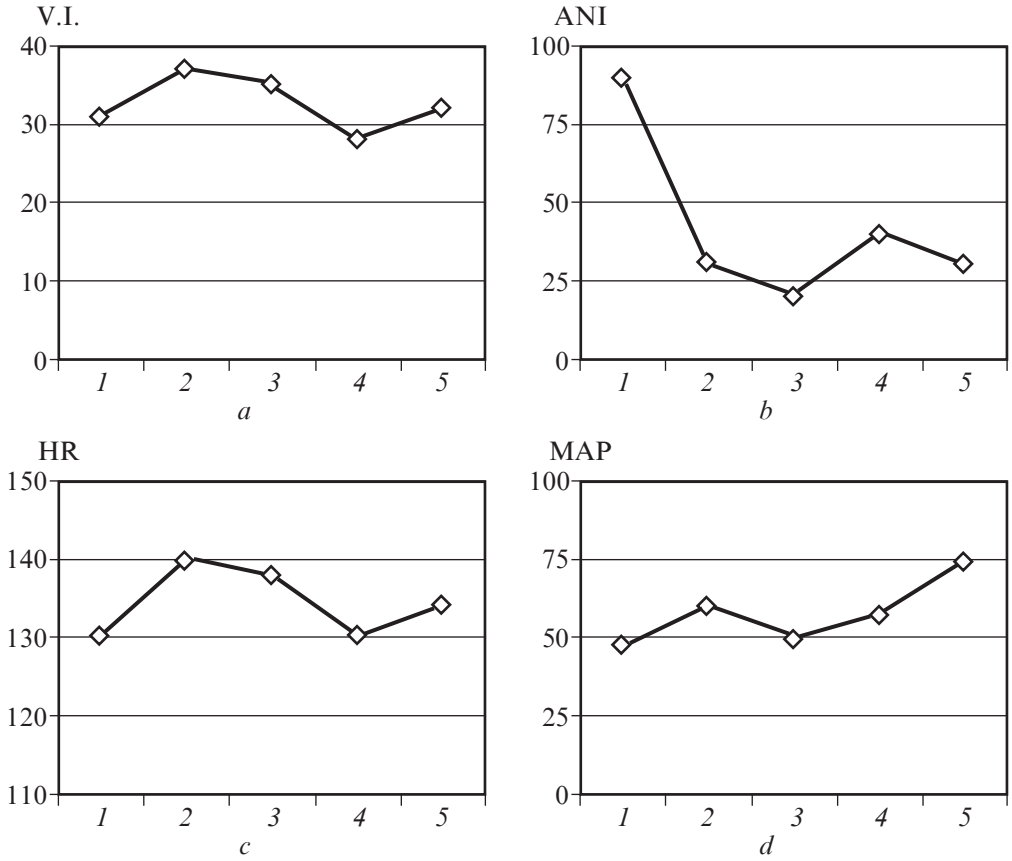

Fig. 1. Dynamics of vegetative index (V.I.), the index of nociception and analgesia (ANI), heart rate, MAP during various procedures in patient with impaired consciousness: *1* — reference level; *2* — bronchoscopy; *3* — gastroscopy; 4 — blood sampling; *5* — catheter suturing

(10-point numerical rating scale), ANI monitoring and V.I., hemodynamic parameters were evaluated.

As seen in Fig. 2, there are differences between the parameters NRS and ANI. In the same answers — on a NRS 2 points, there was a significant dynamic of ANI indicators correlated with V.I. and hemodynamics. So when ANI 36, there is tachycardia (heart rate 139 beats. min.), MAP 117 mm Hg; ANI index with an increase to 49, indicating that the regression of pain, there is a tendency to normalization of hemodynamic parameters heart rate 99 bpm. min, 91 mm Hg MAP ANI. Increasing to 69, accompanied by a normalization of the heart rate to 70 beats. min and MAP up to 88 mm Hg. Reduction of pain 16 hours late after surgery correlates with an increase in consumption of analgesic the patient (Fig. 2).

Discussion. The second clinical case demonstrates the effectiveness of monitoring ANI and V.I., hemodynamic, analgesic consumption in the identification of pain in the early postoperative period after general anesthesia. Patient survey with NRS scale proved to be ineffective (as it turned out, there was no compliance between the patient and the interviewer), — the patient is constantly pointed out the low level of pain, preferring to

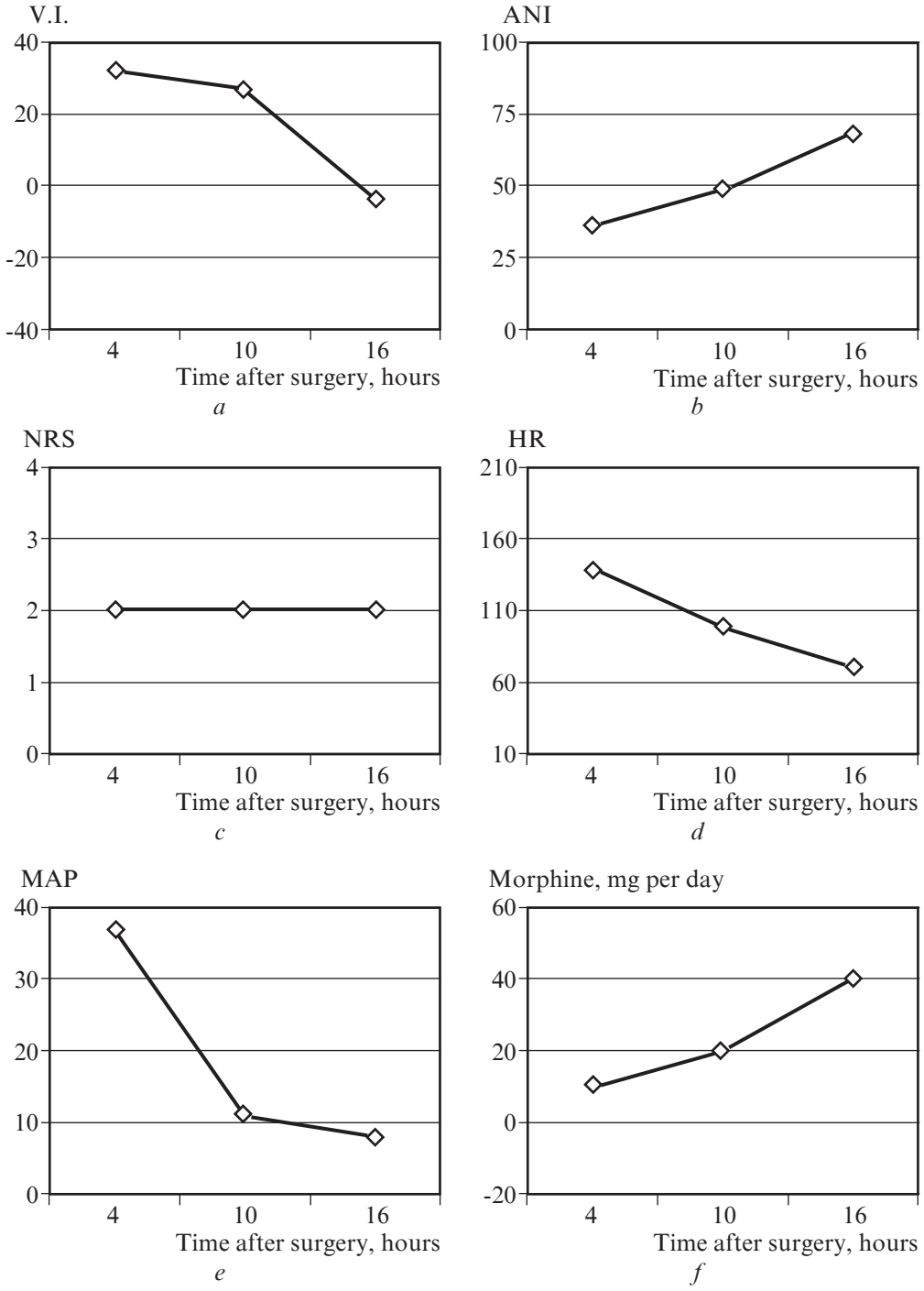

Fig. 2. Dynamics of vegetative index (V.I.), the index of nociception and analgesia (ANI), NRS, HR, MAP and dose of morphine over 4, 10, 16 hours after surgery

"do not complain". However, in the study of other parameters clearly visible dynamics of pain: tachycardia, hypertension, sympathicotonia when calculating V.I., low values of ANI, gradually returning to normal in the amplification of pain relief. Thus, the use of additional methods postoperative "visualization" of pain and not just on the orientation of the patient complaints, paramount takes place in the treatment of pain.

Case 3

Patient F., 74 years old, was observed with the diagnosis: Essential erythremia. Fracture of the left patella. The patient under spinal anesthesia performed osteosynthesis of the left patella. ASA class II. After 10 minutes, after a lumbar puncture at the level of L4–L5 and administration of anesthetic (Marcaine Spinal Heavy 15 mg) produced complete motor and sensory block.

The postoperative period was studied during the recovery of neuromuscular. Hemodynamic monitoring include MAP, heart rate. To assess pain intensity was used NRS scale. Intensity of motor block of the lower limbs was determined by Bromage scale. Due to the fact that the regression of sensory and sympathetic block was significantly positively correlated with the motor block resolution, the block was considered authorized provided the level Bromage 0 [7]. We studied antinoceptive index using ANI-monitor and V.I. After 2 hours after administration of the anesthetic (surgery has been completed, the patient was taken to the recovery room) remained the lack of movement in the legs — 3 points by Bromage scale, The patient does not feel pain — on a scale of NRS-0 points, ANI — 68, MAP 80 mm Hg, heart rate 55 per minute, V.I. — 0 (normotonia). The first signs of regression of motor block were noted after 3 hours from the introduction of local anesthetic in the spinal space — 2 on a scale Bromage, though the patient is not felt pain yet — NRS-scale 0 points, ANI — figure dropped to 52. Complete regression of sensory-motor block observed at 4 hours after the onset of spinal anesthesia — 0 on a scale Bromage, the patient began to complain of severe pain — on a scale NRS-5 points, the index fell to 38 ANI-, heart rate increased slightly, but remained in the normal range — 72 bpm. min., MAP rose to 92 mm Hg but V.I. down from 0 (normotonia) to — 11 (parasympathicotonia) (Fig. 3).

Discussion. Very clear was the study of regression of sensory-motor block in spinal anesthesia. These ANI, except that correspond to the restoration of sensory-motor block, the appearance of pain sensitivity, but also warned of the imminent it occurs (one hour before the spinal block regression ANI decreased from 52 to 38), which is very important in clinical practice and may be used as a signal for the beginning of postoperative analgesia. The study hemodynamic parameters (heart rate, MAP) and V.I. at a resolution of sensory-motor block appeared unrepresentative, that is probably due to the effect of spinal anesthesia, which causes the sympathetic blockade, reducing the total peripheral vascular resistance and the shift in the balance of the autonomic nervous system in the direction of the parasympathetic component.

Conclusion

Thus, visualization and objectification pain seems possible with the help of a comprehensive assessment of various parameters: ANI, V.I., hemodynamic parameters, modern pain assessment scales. At this stage, the use of ANI is the most universal for different clinical situations, however, requires more extensive research.

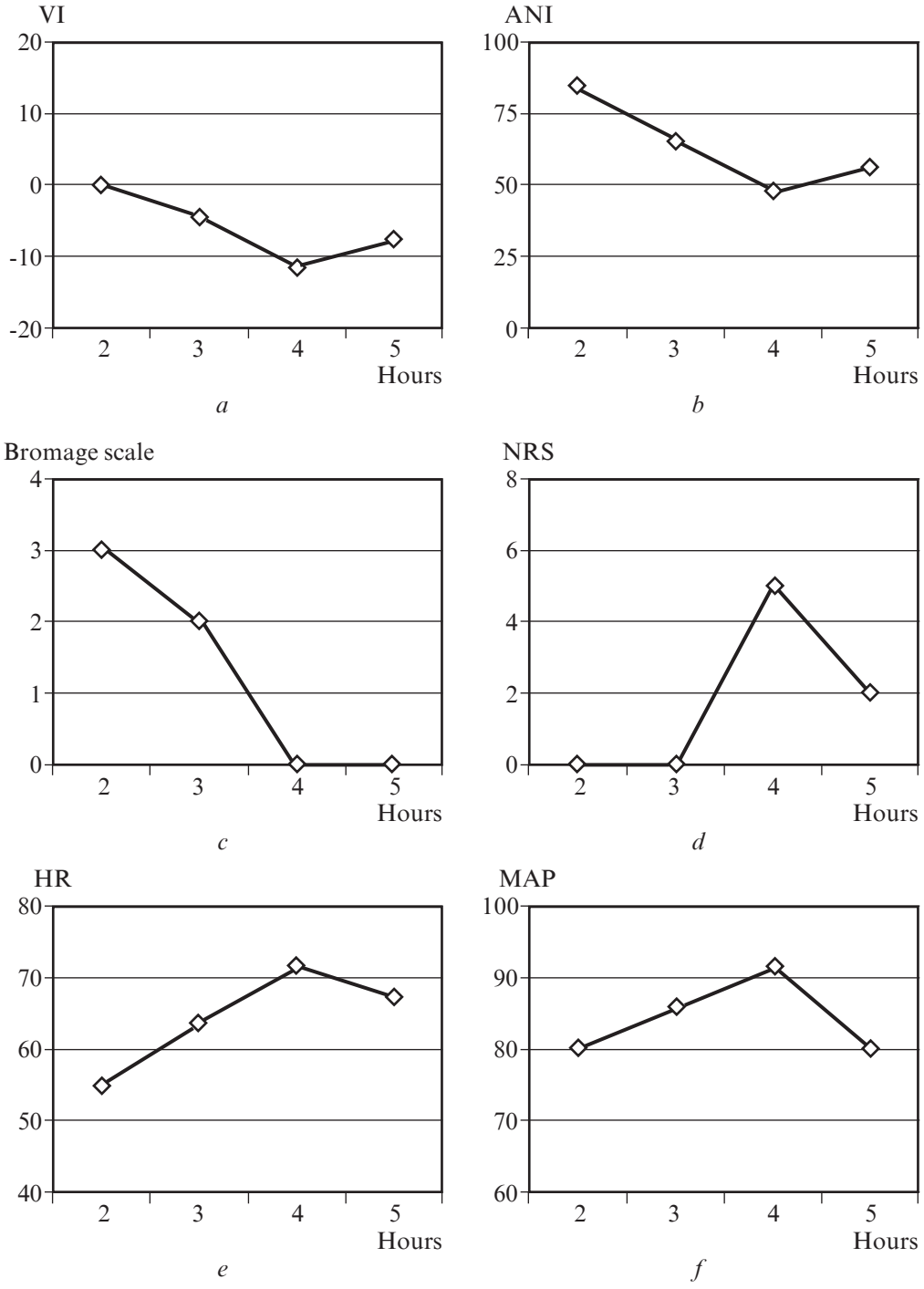

Fig. 3. Dynamics of vegetative index (V.I.), the index of nociception and analgesia (ANI), data Bromage scale, the NRS, HR, MAP through 2, 3, 4, 5 hours after the start of spinal anesthesia

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Conflict of interest: none.

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