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THE EFFECT OF ANESTHESIA ON THE RISK OF POSTOPERATIVE MYOCARDIAL INJURY IN ELDERLY PATIENTS WITH HIP FRACTURE: RANDOMIZED CONTROLLED TRIAL

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Hip fractures are a common pathology among patients older 50 years and cause disability, reduced duration and quality of life, even with adequate management and surgery. In the perioperative period, the most common complications leading to the death of patients are cardiovascular disease. about a hip fracture.

The aim *of our study was to determine the safest method of anesthesia in the context of acute myocardial injury during hip fracture surgery. The objectives of the study were to determine the frequency of postoperative myocardial damage in patients with hip fractures; compare the frequency of MINS with different types of anesthesia: general anesthesia (GA), spinal anesthesia (SA) and compartment psoas block with sciatic nerve block.*

Materials and methods. *Randomized controlled trial was conducted from January 2018 to August 2019 in the medical center "Into-Sana" (Odessa, Ukraine). Patients with planned osteosynthesis of the proximal femur were randomized into 3 groups depending on the method of anesthesia: general anesthesia and postoperative systemic analgesia, spinal anesthesia and postoperative systemic analgesia, prolonged compartment psoas block with sciatic nerve block.*

Results. *The study involved 90 patients. Acute postoperative myocardial injury was diagnosed in 17.6 % of cases. Postoperative elevation of troponins was significantly more often diagnosed in groups of patients with spinal anesthesia and general anesthesia compared to the group in which the psoas block compartment was used in combination with the sciatic nerve block. None of the patients had symptoms of myocardial ischemia and were not diagnosed with myocardial infarction. Hypotension was significantly more common in group 2 spinal anesthesia (OR 9 95 % CI 1.9–47, p=0.004) There was a direct moderate association between the intraoperative hypotension and the development of postoperative myocardial injury (r=0.5).*

Conclusions. *Prolonged compartment psoas block with sciatic nerve block intraoperatively is the safest method of anesthesia in the context of the development of postoperative myocardial injury. Intraoperative hypotension is associated with postoperative myocardial injury*

Keywords: *myocardial injury, compartment psoas block, proximal femur fracture*

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1. Introduction

Hip fractures are a common pathology among patients older than 50 years. In the United States, about 5,000 Americans are hospitalized with this injury each week. In total, about 1 million cases are diagnosed annually worldwide. 1-year mortality after hip fracture ranges from 18 % to 31 % even with adequate management and surgery [1, 2]. The incidence of hip fractures is increasing, which, given the global trend of population aging, creates a significant financial burden for health systems around the world. In the European Union alone, annual costs amount to € 20 billion. Hip fractures in the elderly reduce the physical and psychological activity of patients, in the absence of surgery lead to disability and death from complications [3, 4].

In the perioperative period in hip fractures, the most common complications leading to the death of patients are cardiovascular diseases. In addition to myocardial infarction and myocardial ischemia, postoperative myocardial damage, which is largely caused by intraoperative hypotension, is a significant and underestimated problem. [5] Criteria for myocardial damage are an increase in highly sensitive troponin T (hsTnT) greater than 20 ng/l with or without symptoms of ischemia. Exceptions are cases where the increase in troponin is associated with other non-cardiac causes (sepsis, pulmonary embolism). Also an exception is the increase in troponins due to chronic myocardial damage (hsTnT before surgery 20 ng/l and more) [6].

The aim of the research was to determine the safest method of anesthesia and analgesia for elderly patients with hip fractures in the context of acute myocardial injury.

2. Materials and methods

A randomized controlled trial was conducted from January 2018 to August 2019 at the "Into-Sana" medical center (Odessa, Ukraine). The study included 90 patients

with planned osteosynthesis of the proximal femur, who were randomized into 3 groups depending on the method of anesthesia.

The work was carried out in accordance with the Code of Ethics of the World Medical Association. The study was approved by the Commission on Bioethical Expertise and Research Ethics of NMU named after O.Bogomolets (Expert opinion No. 140 dated 21.12.2020).

Patients in group 1 (*n*=30) underwent catheterization of the lumbar plexus from the posterior access on admission to the hospital and began analgesia with bupivacaine 0.125 % 6–8 ml/h. Intraoperative anesthesia was provided with a bupivacaine bolus of 0.5 % 200 mg into a lumbar catheter and a sciatic nerve block with 1.5 % of 450 mg of lidocaine. Postoperative analgesia was performed with prolonged lumbar blockade with bupivacaine 0.125 % 6–8 ml/h [7].

Patients in group 2 (*n*=30) underwent intraoperative spinal anesthesia at the level of L3-L4 with hyperbaric bupivacaine at a dose of 10–15 mg.

Patients in group 3 (*n*=30) underwent general inhalation anesthesia with sevoflurane with a constant infusion of fentanyl for analgesia.

Postoperative analgesia in the first 3 days was provided by the appointment of paracetamol 3g/day and/or dexketoprofen 75 mg/day. On request, for analgesia used nalbuphine 10 mg. Patients in group 1 and group 2 underwent intraoperative sedation with a constant infusion of propofol 1 % with a target level of sedation on the RASS scale 0–(–2).

Intraoperative monitoring included ECG monitoring, blood pressure and pulse oximetry, BIS (Vista, Medtronic, Ireland) (group 3), capnography (Weinmann, Germany) (group 3). In the postoperative period, round-the-clock monitoring of vital functions, pain for NRS (numerical rating scale) was provided.

The incidence of acute myocardial injury (Myocardial Injury after Noncardiac Surgery, MINS) was assessed in 3 groups. To do this, all patients before surgery and 24 hours after surgery underwent a blood test for quantitative troponin I (ECLIA test) (immunochemical with electrochemiluminescent detection). Criteria for myocardial damage were considered to be an increase in highly sensitive troponin T (hsTnT) greater than 20 ng/l with or without symptoms of ischemia, unless the increase in troponin was thought to be related to other non-cardiac causes or as a result of chronic myocardial damage (hsTnT before surgery 20 ng/l and more).

Statistical analysis was performed using the program Statistica 8.0. Categorical data are presented as proportions, continuous – as the median and Q1–Q3 quartiles. To assess the risk of complications, the logistic regression method was used to determine the odds ratio (OR) of a particular complication and 95 % confidence interval (CI). The probability of error (p) was considered insignificant at $p<0.05$. Spearman's rank correlation coefficient was used to assess the association between intraoperative hypotension and the development of MINS.

3. Research results

The study included 90 patients (30 in each of the three groups). Patients in groups 3 did not differ in sex and age (Table 1). The groups of patients did not differ statistically in the incidence of concomitant pathology, the duration of hospitalization in the intensive care unit – group 1 – 72 [70–75], group 2 – 74 [72–76], group 3 – 72 [70–75] hours (p=0.29) and the total duration of hospitalization – group 1 – 144 [170–184], group 2 – 170 [148–188], group 3 – 178 [144–200] hours.

Table 1

Demographic characteristics of patients in study groups

Indicator / group	Group 1 (*n*=30)	Group 2 (*n*=30)	Group 3 (*n*=30)
Gender, female, n (%)	21 (70)	21 (70)	22 (73)
Age, years *	72 [68-73]	72 [70-73]	73 [72-74]

Note: data are presented as Me [Q1–Q3]

Postoperative myocardial damage was diagnosed in 16 (17.6 %) of 90 patients in all groups. MINS was significantly more often diagnosed in control groups 2 (spinal anesthesia) (OR 9; 95 % CI 1.01–77, *p*=0.048) and 3 (general anesthesia) (OR 11; 95 % CI 1.2–91, *p*=0.03) compared with 1 study group (Table 2). However, none of the patients had symptoms of myocardial ischemia and were not diagnosed with myocardial infarction.

Hypotension was significantly more common in group 2 spinal anesthesia (OR 9; 95 % CI 1.9–47, *p*=0,004)

There was a direct moderate correlation between the presence of intraoperative hypotension and the development of postoperative myocardial infarction (r=0.5).

Table 2

Frequency of acute myocardial damage and hypotension in the studied groups, *n* (%)

Indicator / group	Group 1 (*n*=30)	Group 2 (*n*=30)	Group 3 (*n*=30)
Hypotension	1	12^1	4
Myocardial damage	1^1	7	8

Note: 1 – p<0.05 compared with groups 2 (n=30) and 3 (n=30)

4. Discussion of research results

Postoperative elevation of cardiac troponins often accompanies hip fracture surgery and is associated with cardiac complications in the early postoperative period, as well as with higher 30-day and annual mortality rates in patients older than 65 years. The risks of MINS are incomparably higher in orthopaedic operations, in particular, in osteosynthesis of the proximal femur, compared with other non-cardiac surgeries [8]. Therefore, ensuring adequate analgesia, prevention of cardiac, thromboembolic, infectious, pulmonary complications is the main task of the operating team. Choosing the safest method of anesthesia for the patient is key in this situation.

According to the VISION study (Vascular event sinnon-cardiac Surgery patients cohort evaluation), the incidence of MINS among all non-cardiac surgeries is 8 %. In operations for hip fractures, the rate of increase in cardiac troponins in the perioperative period reaches 36.5 %. Perioperative increase in troponin levels is a predictor of 30-day death in patients older than 65 years [9, 10].

Several methods of anesthesiological support of osteosynthesis of the proximal femur were used: prolonged lumbar plexus block with sciatic nerve block,

spinal anesthesia and general inhalation anesthesia. We evaluated these three methods in terms of safety and risk minimization of MINS and intraoperative hypotension, which in numerous studies has been associated with the development of postoperative myocardial damage.

According to the obtained results, significantly more often myocardial lesions developed when using general anesthesia, less often – when using spinal anesthesia. However, the safest method is lumbar plexus blockade with sciatic nerve block - only 1 patient in this group had postoperative elevations of cardiac troponins.

Hypotension was significantly more likely to develop in group 2, as it is a predictable complication of spinal anesthesia. There was also a moderate direct association between the development of intraoperative hypotension and postoperative myocardial damage.

Study limitations. The main disadvantage of our study is the small set of patients.

Prospects for further research. In the future it is planned to increase the number of study participants. A deeper study of the relationship between hypotension and MINS, as well as other factors that could influence the development of acute postoperative myocardial damage, will be promising in this case.

5. Conclusions

1. The safest method of anesthesia and analgesia in elderly patients with hip fractures in the context of postoperative myocardial damage is prolonged lumbar plexus block with intraoperative sciatic block and sedation.

2. Using this method of anesthesia and analgesia reduced the risk of MINS by 9.95 times (OR 9; 95 % CI 1.01–77, p=0.048) compared with spinal anesthesia and 11 times (OR 11; 95 % CI 1.2–91, p=0.03) in comparison with the general anesthesia.

3. The study obtained new scientific data that reduce the risk of postoperative cardiac complications in elderly patients with hip fractures by using an elongated transverse plexus block in the perioperative period.

Conflict of interests

The authors declare that they have no conflicts of interest.

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