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PATIENTS' WALKING ABILITY AFTER TOTAL HIP ARTHROPLASTY DEPENDS ON THE METHOD OF ANALGESIA

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Background: The methods of perioperative anaesthesia and analgesia can limit physical activity of patients due to motor block of limb and sedative effect of opioids.
Objective: To analyze the influence of perioperative anaesthesia/analgesia technics on patients' walking ability after total hip arthroplasty.
Methods: 150 patients 63.3±12.5 years old patients undergone hip replacement surgery were included in the study. We detected the time intervals required to achieve the ability to pass a 30-meter distance (D30m) after the operation in relevance to intraoperative anaesthesia and postoperative analgesia techniques.
Results: The patients operated under general anaesthesia needed longer time (55.8±19.2 hours) to achieve the ability passing D30m after surgery compared with those operated under paravertebral block+caudal epidural anaesthesia (40.8±17.1 hours, P=0.005), nerve blocks (44.8±13.4 hours, P=0.023) and spinal anaesthesia (48.1±18.6 hours, P=0.08). Three variants of analgesia were used postoperatively in patients. The patients given prolonged paravertebral analgesia needed significantly less time to achieve the ability to pass a D30m after the surgery (38.4±14.8 hours) compared with those who had systemic opioid administration (52.9±18.1 hours, P=0.000006) and those given prolonged epidural analgesia (50.0±17.4 hours, P=0.003). The results of groups given opioids and epidural analgesia did not differ significantly (P=0.48).
Conclusion: The results showed the superiority of paravertebral block and peripheral nerve blocks in early restoration of patients' walking ability compared with general anaesthesia followed by systemic administration of opioids and neuroaxial analgesia.

Key words: *walking ability, hip surgery, anaesthesia, analgesia.*

BACKGROUND

Early rehabilitation is one of the most important factors in prophylaxis of thrombotic events in hip surgery. The methods of perioperative anaesthesia and analgesia can limit physical activity of patients due to motor block of limb and sedative effect of opioids. The **aim** of our study was the analyzing the influence of perioperative anaesthesia/analgesia technics on patients' walking ability after total hip arthroplasty.

MATERIAL AND METHODS

The study was approved by the Kharkiv Medical Academy of Postgraduate Education Ethics Committee (Protocol #5, 23 May, 2013, chairperson prof. O. Bilchenko). Before inclusion informed consent was obtained from all the patients. 150 patients 63.3±12.5 (M±σ) years old were included in the study. All patients undergone total hip replacement surgery via lateral approach at the Kharkiv Regional Traumatologic Clinical Hospital that is the clinics of above named academy.

The patients were randomly divided into six groups (n=25 in each group) according to the intraoperative anaesthesia and postoperative analgesia technics (Table 1). Group 1: intraoperatively spinal anaesthesia were used on the level LIII-LIV with 0.5% bupivacaine 2,4 ml; postoperatively opioids were administred intramuscularly. Group 2: intraoperatively spinal anaesthesia were used on the level LIII-LIV with 0.5% bupivacaine 2,4 ml; postoperatively paravertebral prolonged analgesia using cathether technic and 0.25% bupivacaine 3 ml/h were administred. Group 3: intraoperatively spinal anaesthesia were used on the level LIII-LIV with 0.5% bupivacaine 2,4 ml; postoperatively prolonged epidural analgesia using cathether technic and 0.125% bupivacaine 3 ml/h were administred. Group 4: intraoperatively psoas compartment block and ischiadic nerve block were provided with 1% lidocaine 70 ml with adjuvants (epinephrine 1 : 200 000; dexametazone 4 mg); postoperatively opioids were used intramuscularly. Group 5: intraoperatively paravertebral block with 1% lidocaine 20 ml using cathether technic and epidural block throw the caudal approach with 0.75% ropivacaine 20 ml were administered; postoperatively paravertebral block was prolonged. Group 6: intraoperatively general i/v anaesthesia (thiopental+fentanyl+pipecuronium bromide) with tracheal intubation and artificial ventilation was

Table 1. ***Gender, age, body mass, intraoperative anaesthesia and postoperative analgesia methods in groups***

Group number (n)	Gender: male\female	Age, years	Body mass, kg	Intraoperatively	Postoperatively
I (n=25)	10\15	66.4±9.9	89±17	Spinal anaesthesia	Opioids
II (n=25)	11\14	65.6±13.2	93±17	Spinal anaesthesia	Paravertebral prolonged analgesia using cathether technic
III (n=25)	12\13	65.9±12.1	83±17	Spinal anaesthesia	Prolonged epidural analgesia using cathether technic
IV (n=25)	8\17	60.8±14.0	88±15	Psoas compartment block and ischiadic nerve block	Opioids
V (n=25)	10\15	62.4±10.3	90±19	Paravertebral block using cathether technic and epidural block throw the caudal approach	Prolonged paravertebral block
VI (n=25)	8\17	58.6±14.3	86±18	General i/v anaesthesia	Opioids
Total (n=150)	59\91	63.3±12.5	88±17		

provided; postoperatively opioids were administred intramuscularly. In all patients paracetamol and coxibs were administered as components of multimodal analgesia and wound infiltration with low-concentration of local anesthetic agent was provided. The groups did not differ significantly in age, diagnosis, surgery duration.

Patients were stimulated to early physical activity. They were allowed to walk with a walker from the first postoperative day. Only restrictions in physical activity were not to bend the operated leg in the hip joint by more than 90 degrees, and the prohibition of internal rotation and the abduction of the thigh.

We detected the time intervals required to achieve the ability to pass a 30-meter distance (D30m) after the operation.

All data were recorded and analysed using Portable Statistica 8. Unpaired t-tests were used to analyse the differences between groups and a P-value of <0.05 was considered statistically significant. Statistical analysis was carried out using statistical package for the social sciences (SPSS, v. 11.0 for Windows; SPSS Inc., Chicago, Illinois, USA). Data were presented through tables. The t-test was used to compare proportions, and the t-test was used to compare means. Confidence intervals were reported at the 95% level throughout this study.

RESULTS

The time intervals required to achieve the ability to pass a D30m after the operation were (Mean±SD): in Group I – 58.3±19.0 hours; in Group II – 36.0±12.0 hours; in Group III – 50.0±17.4 hours; in Group IV – 44.8±13.4 hours; in Group V – 40.8±17.1 hours; in Group VI – 55.8±19.2 hours (Figure 1). In Table 2 there are given P values for intergroup differences in the time intervals required to achieve the ability to pass a D30m. The patients in Group II needed the least time to achieve passing D30m. These patients were operated under spinal anaesthesia and gave paravertebral prolonged analgesia via cathether postoperatively. The longest time interval needed patients in Groups I and VI to achieve the ability to pass a D30m. In Group I the patients were operated under spinal anaesthesia and in group VI – under general anaesthesia, but in both groups postoperatively opioids were used.

There were four variants of anaesthesia technic used intraoperatively in our patients (Fig. 2). The patients operated under general anaesthesia (group G, n=25) needed significantly longer time

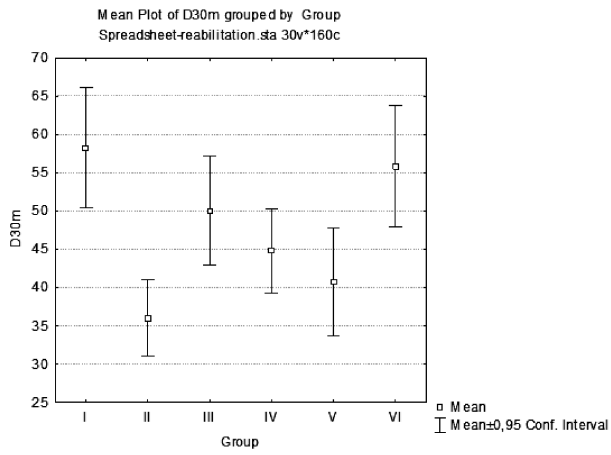

Figure 1. The time intervals (hours) required to achieve the ability to pass a 30-meter distance (D30m) after the operation in Groups I-VI.

(55.8±19.2 hours) to achieve the ability to pass a D30m after the operation compared with those operated under paravertebral block+caudal epidural anaesthesia (group PVE, n= 25; 40.8±17.1 hours, P=0.005) and compared with patients operated under nerve blocks (group NB, n=25; 44.8±13.4 hours, P=0.023). The result of the group G was longer compared with patients operated under spinal anaesthesia but insignificantly (group S, n=75; 48.1±18.6 hours, P=0.08).

Three variants of analgesia were used postoperatively in patients (Fig. 3): group O – opioids (n=75); group PV – paravertebral block (n=50); group E – epidural analgesia (n=25). The

Table 2. ***P values for intergroup differences in the time intervals required to achieve the ability to pass a D30m***

Groups	I	II	III	IV	V	VI
I	–	0.0001	0.116	0.0056	0.0012	0.658
II		–	0.0017	0.018	0.0263	0.00007
III			–	0.238	0.063	0.271
IV				–	0.356	0.023
V					–	0.0052
VI						–

patients given prolonged paravertebral analgesia needed significantly less time to achieve the ability to pass a D30m after the surgery (38.4± ±14.8 hours) compared with those who had systemic opioid administration (52.9±18.1 hours, P=0.000006) and those given prolonged epidural analgesia (50.0±17.4 hours, P=0.003). The results of groups given opioids and epidural analgesia did not differ significantly (P=0.48).

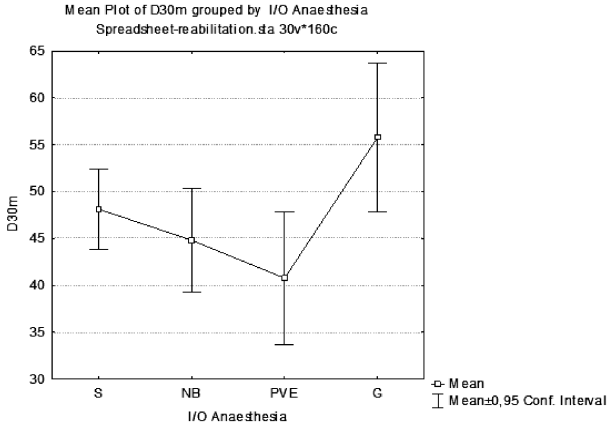

Figure 2. The time intervals (hours) required to achieve the ability to pass a 30-meter distance (D30m) after the operation related to intraoperative anaesthesia technics (Groups: S –spinal anaesthesia; NB – nerve blocks; PVE – paravertebral + caudal epidural block; G – general anaesthesia.

DISCUSSION

Early mobilization is the essential point of rehabilitation after total hip arthroplasty nowadays [8, 14]. Physical activity in early postoperative period provokes increased pain, so the patients need adequate analgesia without limitation of motor functioning of legs. Modern multimodal analgesia protocols after total hip arthroplasty recommend restriction of opioids with emphasizing peripheral nerve blocks [3, 5, 6, 9]. Multimodal pain management has improved pain scores related to activity, decreased narcotic consumption, and enhanced physical therapy participation [4, 7, 12].

Different technics of intraoperative anaesthesia and postoperative analgesia are used in practice in hip surgery [9, 11]. It seems that the patients' physical activity mainly depends on the post-operative analgesia technic than on the intra-operative anaesthesia method. Our results of study the time intervals required to achieve the ability to pass a D30m showed the superiority of para-vertebral block and peripheral nerve blocks compared to general anaesthesia followed by systemic administration of opioids and neuroaxial methods of analgesia.

We found slower restoration of walking ability in patients having opioids, which can be explained due to residual sedative effect of these drugs. Except sedation opiods provide many other side effects as urinary retention, nausea and vomiting, dizziness, which can worsen the general condition of patients. The effect of multimodal pain management on THA rehabilitation was studied in several trials. Singelyn et al. [16] compared the effects of three pain control regimens: intravenous patient-controlled analgesia (PCA) with morphine, prolonged epidural analgesia and prolonged

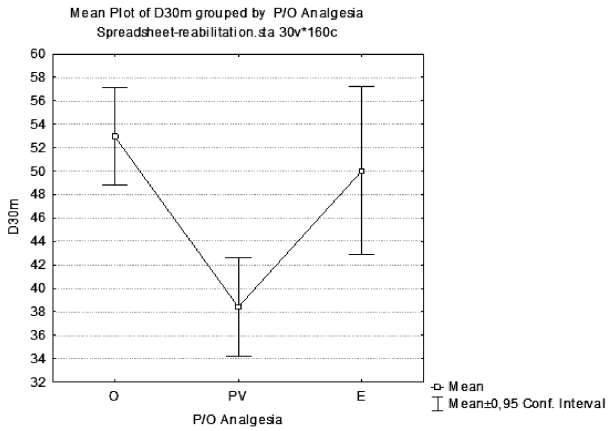

Figure 3. The time intervals (hours) required to achieve the ability to pass a 30-meter distance (D30m) after the operation related to postoperative analgesia methods (Groups: O –opioids; PV – paravertebral block; E – epidural analgesia).

femoral nerve sheath block on rehabilitation after THA. They found a similar pain relief with all three modalities, but the authors declared the superiority of prolonged femoral nerve sheath block due to fewer systemic side effects [16]. In our study opioids were administered intramuscularly 3-4 times a day under the pain intensity monitoring. Nerve blocks stop pain transmissions throw the peripheral nerves. In hip surgery mainly femoral, ischiadic and obturatorius nerves are blocked. The lumbar group of nerves (femoral, obturatorius and cutaneous femoral lateral nerves) can be blocked together in the psoas compartment. Motor component of nerve blocks can be controlled by concentration of local anesthetic agent.

Becchi et al. [2] demonstrated the superiority of the continuous psoas compartment block compared with an opioid/nonsteroidal anti-inflammatory drugs continuous intravenous infusion in THA patients under spinal anesthesia for surgery. The patients receiving continuous psoas compartment block did better in terms of pain scores at rest and after mobilization, amount of rescue analgesia, nausea/vomiting, and hemodynamic parameters [2].

Siddiqui et al. [15] compared continuous lumbar plexus block combined with PCA or PCA alone in patients undergoing THA under general anesthesia and declared less pain intensity, less opioid dose, less nausea and vomiting and more patients'satisfaction with their analgesic technique in group received continuous lumbar plexus block [15].

Parvataneni et al. [10] compared local periarticular injections with PCA on THA patients. They reported improved pain scores and faster functional recovery in terms of active straight leg raise in the study group. However, the ambulation and functional ability were similar between groups at 6 weeks and 3 months after surgery [10]. In our study all patients received wound infiltration with local anesthetic, but this was not a single technique of analgesia.

Andersen et al. [1] studied 80 patients undergoing elective THA under spinal block who were randomly assigned to receive either continuous epidural infusion or infiltration around the hip joint with a mixture of local anesthetic agent, NSAID and epinephrine at the end of surgery followed with one postoperative intraarticular injection of the same substances through an intraarticular catheter. The local infiltration group had lower pain intensity, shorter hospital stays, and reduced nausea and vomiting [1].

Paravertebral analgesia blocks pain impulses at the level of spinal nerves immediately after leaving vertebral column near the intervertebral foramen. This method supply potent analgesia with sympathetic blockage and stable hemodynamic parameters. The potency of motor block provided by paravertebral analgesia can be controlled changing the concentration of local anesthetic agent.

Neuraxial methods (spinal and epidural) provide adequate blockage of pain impulses on the level of spinal cord and roots of spinal nerves passing epidural space. But motor block of limbs on the basis of neuraxial analgesia limits the patients' physical activity. Secondary problems as urinary retention and hemodynamic instability during neuraxial analgesia can affect walking ability of patients worsening their general condition.

CONCLUSION

The study results on walking ability showed the priority of paravertebral block and peripheral nerve blocks compared to general anaesthesia followed by systemic administration of opioids and neuroaxial methods of analgesia in patients after total hip arthroplasty.

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Conflict of interest: None.

REFERENCES

1. *Andersen KV, Pfeiffer-Jensen M, Haraldsted V, Soballe K. Reduced hospital stay and narcotic consumption, and improved mobilization with local and intraarticular infiltration after hip arthroplasty: a randomized clinical trial of an intraarticular technique versus epidural infusion in 80 patients. Acta Orthop. 2007;78:180–186.5.*
2. *Becchi C, Al Malyan M, Coppini R, Campolo M, Magherini M, Boncinelli S. Opioid-free analgesia by continuous psoas compartment block after total hip arthroplasty. A randomized study. Eur J Anaesthesiol.2008;25:418–423.*
3. *Berge DJ, Dolin SJ, Williams AC, Harman R. Pre-operative and post-operative effect of a pain management programme prior to total hip replacement: a randomized controlled trial. Pain. 2004;110:33–39.*
4. *Fischer HB, Simanski CJ. A procedure-specific systematic review and consensus recommendations for analgesia after total hip replacement. Anaesthesia.2005;60:1189–1202.*
5. *Hebl JR, Kopp SL, Ali MH, Horlocker TT, Dilger JA, Lennon RL, Williams BA, Hanssen AD, Pagnano MW. A comprehensive anesthesia protocol that emphasizes peripheral nerve blockade for total knee and total hip arthroplasty. J Bone Joint Surg Am.2005;87 Suppl 2:63–70.*
6. *Horlocker TT, Kopp SL, Pagnano MW, Hebl JR. Analgesia for total hip and knee arthroplasty: a multimodal pathway featuring peripheral nerve block. J Am Acad Orthop Surg. 2006;14:126–135.*
7. *Maheshwari AV, Boutary M, Yun AG, Sirianni LE, Dorr LD. Multimodal analgesia without routine parenteral narcotics for total hip arthroplasty. Clin Orthop Relat Res.2006;453:231–238.*
8. *Munin MC, Rudy TE, Glynn NW, Crossett LS, Rubash HE. Early inpatient rehabilitation after elective hip and knee arthroplasty. JAMA.1998;279:847–852.*
9. *Pagnano MW, Hebl J, Horlocker T. Assuring a painless total hip arthroplasty: a multimodal approach emphasizing peripheral nerve blocks. J Arthroplasty.2006;21:80–84.*
10. *Parvataneni HK, Shah VP, Howard H, Cole N, Ranawat AS, Ranawat CS. Controlling pain after total hip and knee arthroplasty using a multimodal protocol with local periarticular injections: a prospective randomized study. J Arthroplasty. 2007;22(6 Suppl 2):33–38.*
11. *Parvizi J. The merits of regional anesthesia for patients undergoing total hip replacement.Am J Orthop.2007; 36:100*
12. *Peters CL, Shirley B, Erickson J. The effect of a new multimodal perioperative anesthetic regimen on postoperative pain, side effects, rehabilitation, and length of hospital stay after total joint arthroplasty. J Arthroplasty.2006;21:132–138.*

13. Ranawat AS, Ranawat CS. Pain management and accelerated rehabilitation for total hip and total knee arthroplasty. J Arthroplasty.2007;22:12–15.
14. Sharma V, Morgan PM, Cheng EY. Factors Influencing Early Rehabilitation After THA. A Systematic Review. Clin Orthop Relat Res (2009) 467:1400–1411. DOI: 10.1007/s11999-009-0750-9.
15. Siddiqui ZI, Cepeda MS, Denman W, Schumann R, Carr DB. Continuous lumbar plexus block provides improved analgesia with fewer side effects compared with systemic opioids after hip arthroplasty: a randomized controlled trial.Reg Anesth Pain Med. 2007;32:393–398.
16. Singelyn FJ, Ferrant T, Malisse MF, Joris D. Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous femoral nerve sheath block on rehabilitation after unilateral total hip arthroplasty. Reg Anesth Pain Med.2005;30:452–457.

Коломаченко В.І.

ЗДАТНІСТЬ ПАЦІЄНТІВ ХОДИТИ ПІСЛЯ ТОТАЛЬНОГО ЕНДОПРОТЕЗУВАННЯ КУЛЬШОВОГО СУГЛОБА ЗАЛЕЖИТЬ ВІД МЕТОДУ ЗНЕБОЛЮВАННЯ

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МЕТА: Методи періопераційної анестезії і аналгезії можуть обмежувати фізичну активність пацієнтів через моторний блок кінцівки та седативний ефект опіоїдів. Метою нашого дослідження був аналіз впливу періопераційної анестезії / аналгезії на здатність ходити після тотальної артропластики кульшового суглоба.

МЕТОДИ: 150 пацієнтів 63,3 ± 12,5 років, які перенесли операцію із заміни кульшового суглоба, були включені в дослідження. Ми визначали час, необхідний для досягнення здатності пройти 30-метрову відстань після операції, в залежності від методів інтраопераційної анестезії і післяопераційної аналгезії.

РЕЗУЛЬТАТИ: Пацієнти, які оперувались під загальною анестезією, потребували більше часу (55,8 ± 19,2 години) для досягнення здатності долати 30 метрову дистанцію після операції в порівнянні з пацієнтами, які оперувались в умовах паравертебрального блоку + каудальної епідуральної анестезії (40,8 ± 17, 1 години, P = 0,005), нервових блоків (44,8 ± 13,4 години, P = 0,023) або спінальної анестезії (48,1 ± 18,6 години, P = 0,08). Три варіанти аналгезії застосовувалися в післяопераційному періоді у пацієнтів. Пацієнтам, які отримували тривалу паравертебральну аналгезію, треба було значно менше часу для досягнення здатності долати 30 метрову дистанцію після операції (38,4 ± 14,8 години) в порівнянні з тими, які отримували системне введення опіоїдів (52,9 ± ± 18,1 години, P = 0,000006), і тривалу епідуральну аналгезію (50,0 ± 17,4 години, P = 0,003). Результати груп, які отримували опіоїди і епідуральну аналгезію, істотно не відрізнялися (P = 0,48).

ВИСНОВКИ: Паравертебральна блокада і блоки периферичних нервів мають перевагу в ранньому відновленні моторної активності пацієнтів після артропластики кульшового суглоба в порівнянні із загальною і нейроаксіальною анестезією з подальшим системним введенням опіоїдів.

Ключові слова: *ходьба, хірургія стегна, анестезія, аналгезія.*

Коломаченко В.И.

СПОСОБНОСТЬ ПАЦИЕНТОВ ХОДИТЬ ПОСЛЕ ТОТАЛЬНОГО ЭНДОПРОТЕЗИРОВАНИЯ ТАЗОБЕДРЕННОГО СУСТАВА ЗАВИСИТ ОТ МЕТОДА ОБЕЗБОЛИВАНИЯ

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ЦЕЛЬ: Методы периоперационной анестезии и аналгезии могут ограничивать физическую активность пациентов из-за моторного блока конечности и седативного эффекта опиоидов. Целью нашего исследования был анализ влияния периоперационной анестезии / анальгезии на способность ходить после тотальной артропластики тазобедренного сустава.

МЕТОДЫ: 150 пациентов 63,3 ± 12,5 лет, перенесших операцию по замене тазобедренного сустава, были включены в исследование. Мы определяли время, необходимое для достижения способности пройти 30-метровую дистанцию после операции, з зависимости от методов интраоперационной анестезии и послеоперационной анальгезии.

РЕЗУЛЬТАТЫ: Пациентам, которые оперировались под общей анестезией, потребовалось более длительное время (55,8 ± 19,2 часа) для достижения способности пройти 30-метровую дистанцию после операции по сравнению с пациентами, которые получали паравертебральный блок + каудальную эпидуральную анестезию (40,8 ± 17,1 часа, P = 0,005), нервные блоки (44,8 ± 13,4 часа, P = 0,023) или спинальную анестезию (48,1 ± 18,6 часа, P = 0,08). Три варианта анальгезии применялись в послеоперационном периоде у пациентов. Пациентам, получавшим длительную паравертебральную аналгезию, потребовалось значительно меньше времени для достижения способности пройти 30 метровую дистанцию после операции (38,4 ± 14,8 часа) по сравнению с теми, у кого было системное введение опиоидов (52,9 ± 18,1 часа, P = 0,000006), и у пациентов с длительной эпидуральной анальгезией (50,0 ± 17,4 часа, P = 0,003). Результаты групп, получавших опиоиды и эпидуральную аналгезию, существенно не отличались (P = 0,48).

ВЫВОДЫ: Паравертебральная блокада и блокив периферических нервов имеют преимущество в раннем восстановлении ходьбы у пациентов после артропластики тазобедренного сустава по сравнению с общей и нейроаксиальной анестезией с последующим системным введением опиоидов.

Ключевые слова: *ходьба, хирургия бедра, анестезия, анальгезия.*