

UPOREDNA POSTOPERATIVNA ANALGEZIJA N. FEMORALIS BLOKOM "3-U-1" I FASCIA ILIACA COMPARTMENT NERNVIM BLOKOM POSLE ALOARTROPLASTIKE KUKA

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COMPARATIVE POSTOPERATIVE ANALGESIA WITH FEMORAL NERVE BLOCK "3-IN-1" AND WITH FASCIA ILIACA COMPARTMENT NERVE BLOCK AFTER HIP ALLOARTHROPLASTY

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SAŽETAK

Cilj. Artroplastika kuka je jedna od najčešćih operacija u starijoj populaciji. Preoperativni i postoperativni rizici povećavaju njen postoperativni morbiditet i mortalitet. Bol je jedan od najvažnijih faktora uključenih u perioperativne rizike. Kontrola postoperativnog bola smanjuje učestalost i težinu naknadnih komplikacija.

Metode. Usporedili smo tri različite tehnike kupiranja bola kod 30 bolesnika planiranih za elektivnu artroplastiku kuka: 1) farmakološku – morfin 5 ili 10 mg (u zavisnosti od telesne mase) i.v. na svaka četiri sata, i paracetamol 1 g i.v. na svaka četiri sata (MP), 2) blok n. femoralis (FNB) i 3) fascia iliaca compartment nerve block (FICNB). Merenje intenziteta bola izvedeno je primenom numeričke skale za bol (NPS). Registrovani su sistolni krvni pritisak i primena dodatnih na zahtev pacijenata, kao i trajanje bloka nerava.

Rezultati. Oba bloka nerava obezbedila su značajno niže skorove za bol od čisto farmakološkog pristupa (MP $5,4 \pm 0,6$ prema FNB $2,8 \pm 1,6$ i FICNB $2,9 \pm 1,2$ posle prvog postoperativnog sata). Sledstveno tome, bolesnici iz MP grupe zahtevali su više dodatnog morfina i paracetamola posle isteka prvog sata, u poređenju s bolesnicima iz FNB i FICNB grupa. Morfin je znatno češće dodavan u MP grupi ($3,4 \pm 0,4$ mg/kg i.v.), nego u FNB ($2,1 \pm 0,5$ mg/kg i.v.) i FICNB grupi ($2,5 \pm 0,4$ mg/kg i.v.). Najduže trajanje analgezije bilo je 5 h u MP grupi, u poređenju sa 9 h, odnosno 8 h, posle FNB, odnosno FICNB.

Zaključak. Postoperativna analgezija nervnim blokovima obezbeđuje bolju kardiovaskularnu stabilnost i manje neželjenih efekata nego klasična analgezija zasnovana na morfinu.

Ključne reči: analgezija; morfin; nervni blok; artroplastika, zamena, kuk.

ABSTRACT

Objective. Hip arthroplasty is one of the most common operations in elderly population. Pre- and postoperative risks increase their postoperative morbidity and mortality. One of the most important factors, which is included in the perioperative risks, is pain. Control of postoperative pain diminishes the incidence and severity of complications afterwards.

Methods. We compared three different techniques of pain control in 30 patients scheduled for elective hip arthroplasty: 1) pharmacological – morphine 5 or 10 mg iv q6h, depending on body weight, paracetamol 1 g i.v. q6h (MP), 2) nerve block: femoral nerve block, single shot (FNB) and 3) fascia iliaca compartment nerve block (FICNB). Measurement of pain intensity was performed with numerical pain scale (NPS). Systolic blood pressure and consumption of additional analgesics on demand were monitored, as well as the duration of nerve blocks.

Results. Both nerve blocks produced significantly lower pain scores than the purely pharmacological approach (MP $5.4+0.6$ vs. FNB $2.8+1.6$ and FICNB $2.9+1.2$ after the first postoperative hour). Consequently, the first group required more additional morphine and paracetamol after the first hour compared to FNB and FICNB groups. Morphine was significantly more frequently added in the MP group ($3.4+0.4$ mg/kg IV) than in the FNB ($2.1+0.5$ mg/kg i.v.) and FICNB ($2.5+0.4$ mg/kg i.v.). Maximal duration of analgesia was 5 hours in MP group compared to 9 and 8 hours after FNB and FICNB, respectively.

Conclusion. Postoperative analgesia with blocks enables better pain control, better cardiovascular stability and less adverse effect than the classical morphine-based analgesia.

Key words: analgesia; morphine; nerve block; arthroplasty, replacement, hip.

INTRODUCTION

Coxarthrosis is a disease of the elderly population. The only radical solution for the advanced stages of coxarthrosis is hip alloarthroplasty. Moving of the upper age limit for this operation over 100 years increased the postoperative morbidity and mortality. Hip alloarthroplasty has become a greater challenge, since they have become more frequent. They belong to a group of the most successful operations in the geriatric population, based on the Medical Outcome Study 36-Items Short Form Health Survey SF36 (1) in terms of the improvement of the quality of living, since these patients after the operation achieve the preoperative quality of living status of their non-coxarthrotic peers.

Factors influencing the gravity of the operation and the postoperative recovery are patients, their age, accompanying diseases, such as angina pectoris (AP), chronic cardiomyopathy, arrhythmia, chronic obstructive pulmonary (COPD), deep vein thrombosis, dehydration, varicosities, their physiological and psychological characteristics, operation, preoperative preparation, the surgical technique used etc. McLaughlin et al. (2) performed a prospective study of 804 patients with hip fracture. It was established that the preoperative mortality was 0.8%, postoperative complications 7%, cardiopulmonary 5.8%, thromboembolic 1.8%, infections 1.6% and haematologic 0.4%. In 23% and 34% of these patients minor and more serious laboratory abnormalities were found, respectively.

Pain aggravates the status of these patients, since it is a usual symptom accompanying chronic degenerative lesions. Pain also dominates the clinical picture of the fractured hip and it also occurs during the postoperative period. It adversely affects the respiratory function, cardiovascular stability, hydration and nutrition (loss of proteins, glucose intolerance, electrolyte dysbalance) and leads to the neuropsychiatric complications – delirium, depression, altered response to acute and chronic stress and sleep impairment (3).

Postoperative pain is, according to the definition of the American Society of Anesthesiologists (ASA) an unpleasant sensory or emotional experience associated with actual tissue damage occurring due to a surgery. The World Health Organization has recognized the adequate pain relief as a fundamental human right (4). Therapy of patients with hip fracture can be preoperative, intraoperative and postoperative (5). Postoperative pain therapy includes psychological and pharmacological support – opioid analgesics, regional anesthesia and non-steroidal anti-inflammatory drugs (NSAID). Preoperatively, in case that there are no contraindications, a patient should be treated with NSAID (diclofenac, meloxicam, ketorolak tromethamine) or paracetamol 1g

q6h IV/IM/PO with IV analgesia on demand – patient-controlled analgesia (PCA) with morphine (1 mg/5 min) or by IM (5-10 mg q8h) or IV boluses of morphine (up to 2.5 mg) or tramadol 50 mg q6h PO.

The use of drugs in older age has limitations arising from the patient's physiologic status and the drug adverse effects. The contraindications of paracetamol are renal or hepatic failure and serum creatinin >200 $\mu\text{mol/L}$. NSAID can produce a number of adverse effects: irritation of gastrointestinal tract (in 7.6% patients), acute renal failure, headache, vertigo, increase in transaminase plasma activities, hepatitis, edema, fluid retention, thrombocytopenia, coagulation disorders. Diclofenac is one of the most commonly used and one of the most potent NSAID (6). It is comparable to indomethacin and naproxen. It is much more effective than aspirin, pirazolone derivatives and other NSAID. Its effect does not depend on the route of administration. The same effect can be achieved by oral, intramuscular and rectal use. In the gastric mucosa no correlation was found between the level of mucosal damage and the inhibition of prostaglandin synthesis.

Opioids require careful dosing and increased subsequent supervision of patients, because of the threatening respiratory depression. Pethidine and propoxyphene can induce and enhance the existing delirium, while tramadol can induce drug dependancy, interaction with skeletal muscle relaxants, hepatic and renal failure. Exactly for this reason, patients are frequently subdosed because of the fear from adverse effects of opioids (7).

Many of these adverse effects can be avoided by using regional anesthesia instead, although it also has its own adverse effects (8). Spinal anesthesia can induce hypotension, anuria, prolonged anesthesia, too high a block. The use of blocks brings a threat of cardiotoxic effects of anesthetics and neuritis (30%).

This study aimed to investigate and compare the qualitative and quantitative aspects of postoperative analgesia following three different techniques – the classical pharmacological one and two nerve block techniques based on the injection of local anesthetics – Femoral Nerve Block “3-in-1” (FNB) and Fascia Iliaca Compartment Nerve Block (FICNB).

PATIENTS AND METHODS

The study was performed at the Institute for Orthopedic Surgery “Banjica”, Belgrade during the period 2009-2010. The permission was received from the Ethics Committee of the Institute. The study was prospective and randomized and it included 30 patients. Block randomization was used to assure the absence of bias.

Their demographic characteristics were: average age 71 years (range 58-86), ASA classification status II and III, gender ratio male: female = 10:20, average weight 78±5 kg, average height 178±12 cm, average duration of operation 128±12 min.

According to the study protocol, all patients received after the operation standard analgesia: morphine 5 or 10 mg IV q6h (patients weighing up to 60 kg and above it received 5 mg and 10 mg respectively) and paracetamol 1 g IV q6h. Patients were randomly allocated to three groups, based on the type of analgesia administered immediately before the transfer from the operating theatre: a) group I – standard analgesic therapy (morphine, paracetamol) – MP group; b) group II – FNB "3-in-1" block, single dose of local anesthetic – FNB group; group III – FICNB, single dose of local anesthetic – FICNB group.

FNB was performed in the inguinal region as "3 in 1" block according to Winnie et al (9), continuous technique modified by Rosenblatt et al (10). It includes injection of 30-40 ml of local anesthetic (1% lidocaine, 0.25% mepivacaine or 0.75% ropivacaine). The technique for performing the FICNB was first described by Dalens et al (11, 12) and it was originally developed for children. It is usually produced by administering a single injection of 30-40 ml of local anesthetic to block the three branches of lumbar plexus: n. cutaneus lateralis, n. femoralis and n. obturatorius.

The following parameters were registered: the level of analgesia (based on the numeric pain scale) over the 10 h postoperative period, analgesic consumption – extra doses on patients' demand, duration of block, cardiovascular parameters. Statistical analysis was performed with SPSS programme, with analysis of variance and later comparisons between the individual values performed with Tucky test.

RESULTS

In the first 10 postoperative hours the NPS scores were compared in all three groups of patients (Figure 1). Group I (MP) which received standard postoperative pain therapy (morphine 5-10 mg i.v. q6h and paracetamol 1g q6h i.v.) produced significantly higher values of pain scores than groups II (FNB) and III (FICNB). There were no

significant differences in PNS scores between the FNB and FICNB groups (fig. 1).

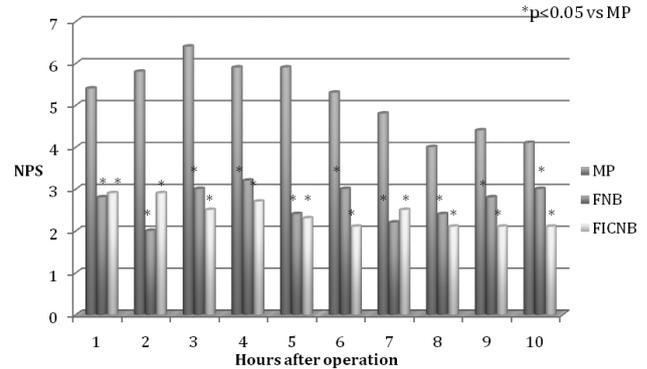


Figure 1. Influence of analgesic regimens on postoperative pain scores in patients after hip alloarthroplasty.

Morphine and paracetamol had to be significantly more frequently added over the standard doses of analgesics in the MP group, in comparison with the the FNB and FICNB groups. Additional doses of morphine did not significantly differ between FNB and FICNB groups (Figure 2). It is obvious from Table 1 that the two blocks – FNB and FICNB – provided longer lasting analgesia than those in the classical MP group, since it took patients from these groups much longer to require additional morphine/paracetamol than in the MP group (9 and 8 h, respectively vs. 5 h). The difference in the duration of the two blocks was not significant (Table 1).

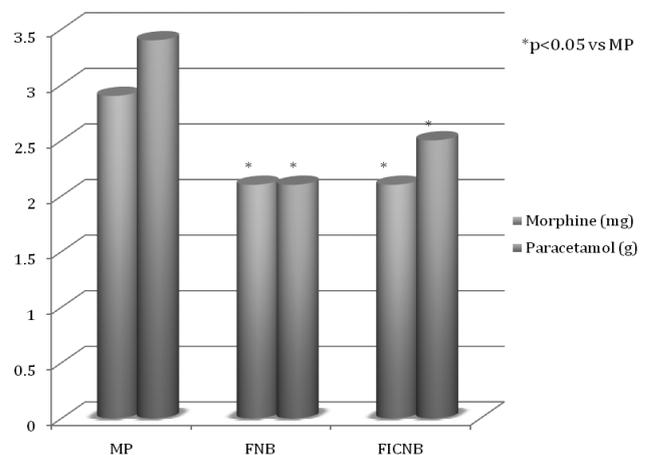


Figure 2. Additional consumption of postoperative analgesics in patients with hip alloarthroplasty.

Table 1. Parameters of analgesia in the three groups of patients after hip alloarthroplasty

Group	Time 1 (h)*	Time 2 (h)**	Duration of block (h)***
MP	1	5	-
FNB	1	9	4.89 ± 1.36
FICNB	2	8	5.16 ± 2.76

*after operation until the first extra dose of analgesic,
 until first need for extra dose of analgesic, *the mean+standard deviation

Patients in MP group had higher values of systolic blood pressure than the other two groups. These differences were significant only after the first and the second hour. The differences among the two groups with blocks were not significant (Figure 3).

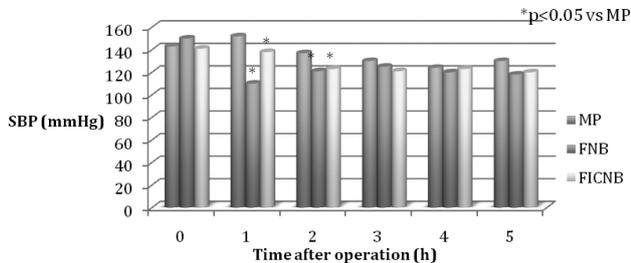


Figure 3. Changes in systolic blood pressure in three groups of patients after hip alloarthroplasty

DISCUSSION

Pain control after total hip alloarthroplasty can be problematic. In half of all patients undergoing such a surgery, pain can increase without any movements or after unwilling contraction of the m. quadriceps (13). Analgesia with morphine iv boluses can be satisfactory compared to im/iv boluses in patient-controlled analgesia (PCA), but it is not quite sufficient after involuntary contractions of quadriceps muscle, which occur very often after hip or knee replacement, or after movement (14).

The use of regional analgesia and anesthesia - especially blocks - is getting more and more frequent while in the past there was some prejudice because of the complex innervation of that region due to plexus lumbalis and plexus sacralis. Sometimes, the use of blocks per se is not sufficient (15). The advantages of blocks are: they can be used unilaterally and cardiovascular parameters are more stable compared to the use of morphine or spinal analgesia (12). Our results completely confirm such a claim. Although the use of a block alone is not sufficient in pain control for the hip replacement intraoperatively, it can be used for postoperative pain control with or without addition of morphine.

Stevens et al. (1) and Syngelin et al. (13) found, like us, that the use of the same blocks improves cardiovascular stability and decrease additional doses of morphine in the postoperative period. The reduction of pain in the Numeric Pain Scale (NPS) was significant 2, 4 and 6 hours after operation in Monzon's study (7), which is similar to our own results.

In three American studies (7, 16, 17) that compared the effects of FICNB vs. morphine it was shown that NPS 15 minutes after the operation was 6.24 ± 0.17 and 2.9 ± 0.16 and that this effect was significantly reduced after 2 h. In our study analgesic effects were measured only after the first postoperative hour and it was significantly decreased in both FNB and FICNB groups compared to the

morphine group. There were no significant differences among groups in NPS values between the first and second hour. In our study, like in the Høgh et al. study (18), extra doses of analgesics in FNB and FICNB were lower than in the control group. In opioid group variation of cardiovascular parameters were more often, but these effects were not statistically significant, with the exception of the first two hours after the end of the operation.

In conclusion, the use of FNB and FICNB for postoperative analgesia reduces consumption of analgesics (morphine and paracetamol) and enables better stability of cardiovascular function. BNF is more precise because of the usage of neurostimulator or ultrasound, while FICNB is easier to perform, faster and safer, especially for the use in children.

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