

A.H.Onutu, E.Fatnic

The influence of femoral nerve block on cognitive dysfunction following trochanteric hip surgery

(Romania- Republic of Moldova)

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This study aimed to prospectively assess the influence of a single preoperative administration of femoral nerve block on the early incidence of postoperative cognitive dysfunction (POCD) after trochanteric surgery in aged patients. The study received institutional approval of the Ethics Committee. The inclusion criteria were: ASA II-III patients with single trochanteric fracture scheduled for surgery, age > 75 years, lack of known allergies. Sixty patients, who signed informed consent, were randomized in FB group (n=30) to receive femoral block with 0.375% bupivacaine before anesthesia and C group (n=30) to receive a sham block at the very moment. The proposed anaesthetic for all patients was spinal anaesthesia with 0.5% plain bupivacaine. Mini Mental Status Examination (MMSE) was recorded preoperatively and postoperatively, at 24 and 48 hours. A reduction by ≥ 2 points in MMSE score, compared to baseline values, was considered cognitive disfunction. Postoperative analgesic plan was the same for the two groups and included IV acetaminophen 1g td and tramadol IM 1 mg/kg at 4 hours. Morphine 0.05mg/kg was administered subcutaneously at pain scores with movement greater than 3 on the numerical pain scale (NRS). Total postoperative morphine consumption for the first 24 postoperative hours was recorded. Our results showed a better postoperative cognitive status in group FB with higher MMSE scores (p=0.01) and only 7% presented POCD in group FB as compared with 52% in group C (p=0.001). The median amount of 24-hour total morphine consumption was higher in group C, 4 mg while it was none in group FB (p<0.05). Preoperative femoral nerve block appears to reduce the incidence of early POCD in patients scheduled for trochanteric surgery in spinal anaesthesia.

Key words: femoral block, POCD, MMSE, trochanteric fractures, elderly

Introduction: Aged patients are known at risk to develop cognitive impairment after trochanteric surgery. Postoperative cognitive dysfunction (POCD) defined as a nonspecific decline of cognitive functions (without an alteration of the mental status or awareness) is mainly encountered in the elderly early after surgery with a variable incidence reported between 19-75% (1). This postoperative unpleasant status, and at least in some patients reversible, resolves shortly after or may persist for weeks thereafter. However, POCD is associated with important complications, increased hospitalization and costs, and recently in non-cardiac surgery POCD has been identified as an important risk factor for increased mortality (2). Several factors were found to predict the risk of COPD beside advanced age: duration of surgery and anaesthesia, infections, postoperative respiratory complications, reinterventions, anemia, cerebral hypoxia and alcohol dependence. Deep general anaesthesia appears to increase the risk of POCD, as well as postoperative administration of important amounts of morphine and other narcotics (3, 4). Possible mechanisms involved in its etiology include neuroinflammation, neurodegeneration, microemboli and cerebral oxygen desaturation (5, 6, 7). Numerous studies have shown benefits of regional anaesthesia and regional analgesia in reducing the incidence of POCD in general and orthopaedic surgery (8) but available data are still lacking enough evidences regarding the role of regional analgesia and also a unity in utilization of widely accepted, validated tools for the assessment of POCD. Femoral nerve block included in the perioperative pain management plan proved to be effective after orthopaedic surgery (9). Mini Mental Status Examination evaluates cognitive function testing orientation, registration, attention and calculation, recall, and language and it proved useful for detection the perioperative cognitive decline (10). The aim of this study was to assess if a single preoperative administration of the femoral nerve block may influence the incidence of postoperative cognitive dysfunction in patients with trochanteric fractures scheduled for internal fixation in spinal anaesthesia. The primary endpoint of the study was the evaluation of MMSE score at 24 and 48 hours postoperatively and the secondary endpoint was the 24-hour total morphine consumption.

Materials and Methods: With institutional approval and signed informed consent 60 patients ASA II-III, with trochanteric fractures, were prospectively enrolled in the study. Inclusion criteria were: age >75 years, patients with single trochanteric fracture scheduled for internal fixation. Patients known with dementia and other neuropsychiatric disorders, alcohol abuse, known allergies, renal and hepatic insufficiency were excluded. Patients were randomized, using the sealed envelope method, and assigned to: - Group FB (n=30) to receive femoral nerve block with 0.375% bupivacaine, before spinal anaesthesia - Group C (n=30) control, to receive a femoral sham block, before spinal anaesthesia. Every patient completed Mini Mental Score Examination (MMSE) before surgery. After arrival in the operating room a 17-gauge peripheral venous cannula was inserted, in the forearm, 1 mg midazolam given for anxiolysis and a lactated Ringer's solution infusion started. Patients were monitored continuously: ECG (DII), pulseoximeter and automatic non-invasive arterial blood pressure. In group FB femoral nerve was localized using a nerve stimulator and the block performed with 20 ml 0.375% bupivacaine. After palpation of femoral artery and the skin marked and prepared with iodine and sterile drapes, the local anaesthetic solution was injected when quadriceps response with an output of 0.5 mA or less was obtained, through a 21-gauge, 5 cm isolated needle. In group C a skin puncture was done, using the same landmarks, as a sham block. All patients received spinal anaesthesia with 0.5% plain bupivacaine (7.5 - 15 mg), at L2-L3 intervertebral space using 22 G needles. After that all of them got internal fixation of the femur with gamma nails or dynamic hip screws. Oxygen 4l/min was administered continuously during surgery via facial mask. Blood losses were replaced with crystalloids, colloids and packed red blood cells to maintain hemoglobin levels above 9g/l. Plasma electrolytes were corrected when needed. Hypotension episodes (20% decreases from baseline values) were promptly treated with infusion and *iv* 5-10 mg ephedrine boluses. Bradycardia (heart rate <45) was treated with 0.5mg atropine boluses. Postoperatively all the patients attended postanesthesia care unit and analgesia was established and maintained with acetaminophen *iv* 1 g every 12 hours and tramadol *im* 1 mg/kg every 4 hours. Morphine 0.05mg/kg was administered subcutaneously at pain scores with movement greater than 3 on the 11 digits numerical pain scale (NRS) (0-no pain, 10-the worst imaginable pain). Total postoperative morphine consumption in the first 24 postoperative hours was recorded. Mental status was reevaluated postoperatively at 24 and 48 hours, by an independent investigator. A complete correct examination rates a maximum score of 30 points and patients with scores < 23 being severe impaired (delirium, dementia). Compared to the

preoperative assessment a reduction by ≥ 2 points was considered as cognitive impairment (1). The pdf of the MMSE form used is presented at http://www.sco.edu/assets/1813/course_5_b_handout.pdf. Data are presented as mean and standard deviation or median and range. Statistical analyses were performed using the two-sided Student's *t* test, unpaired *t* test, Mann Whitney-U or Chi square test as required. A *p* value < 0.05 was considered significant. According to data distribution, results are expressed as mean \pm standard deviation (SD) or as median (range). Statistical analysis was performed using the SPSS 9.0 (SPSS Inc., Chicago, IL, USA) for Windows.

Results and Discussion: Sixty patients (27 male, 33 female) completed the study between November 2014 and March 2015 (Fig.1).

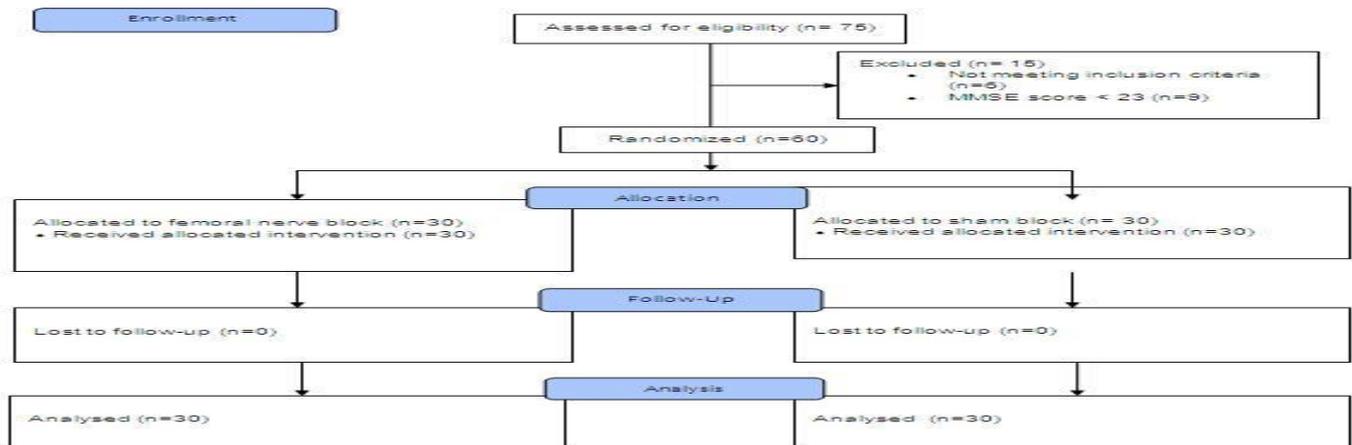


Fig. 1 The flow chart of the study

Each study group comprised 30 patients. The baseline characteristics of the groups were comparable regarding: age, sex, ASA status, duration of surgery, preoperative hemoglobin level and were shown in Table1.

Parameter	Group FB (n=30)	Group C (n=30)
Age (years)	77.6 (8)	77.8 (6.5)
ASA status:		
II	19	16
III	11	15
Sex (M/F)	12/18	15/15
Preoperative hemoglobin (g/l)	9.74 (1.07)	10.02 (1.37)
Type of surgery :		
Gamma nail (number)	22	19
DHS (number)	8	11
Surgery time (min)	86.66 (14.75)	84.33 (14.72)

FB-femoral block group; C-control group; ASA- American Society of Anesthesiology physical status, DHS- dynamic hip screw

Data are presented as mean (standard deviation) or numbers.

Table 1. Patients' baseline characteristics

The overall early incidence of POCD was 60% (18/30). There was a significant difference between the two groups: 7% (2/30) in group FB and 52% (16/30) in group C ($p < 0.001$). Female were more affected than male and results showed a ratio female/male of 13/5 (Fig. 2).

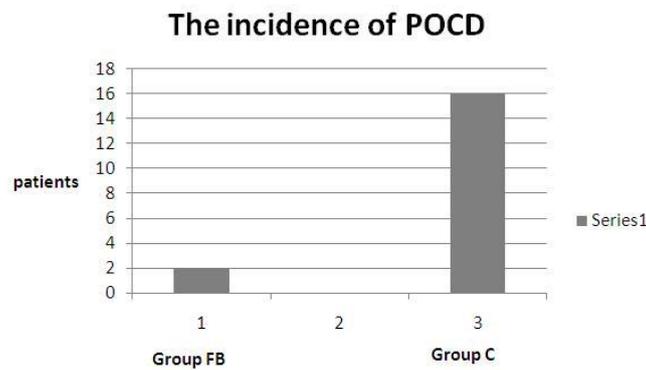
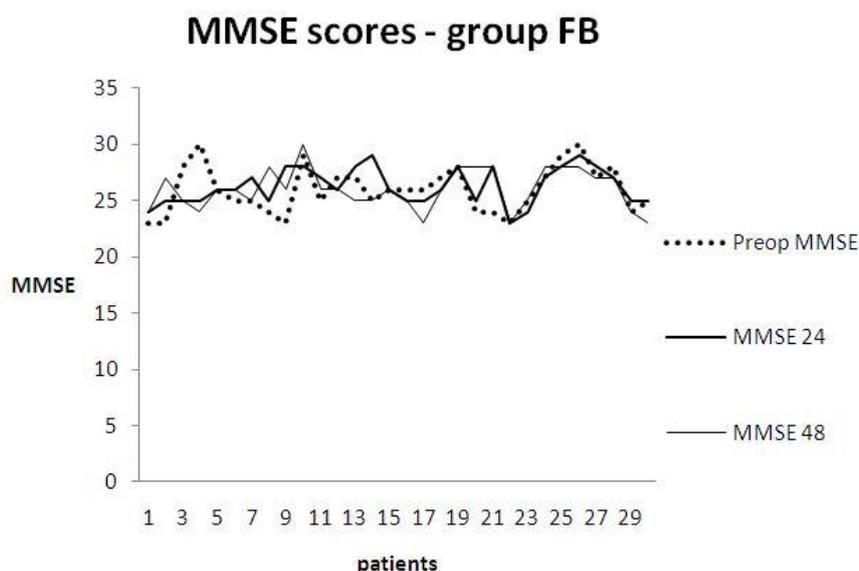


Figure 2. The incidence of POCD

The 48 hours evaluation of MMSE revealed two new cases of cognitive decline in group C, as compared with the previous examinations. The MMSE values are illustrated in Fig. 3 for group FB and in Fig. 4 for the group C. Overall MMSE score showed a preoperative average value of 26.23 (2.19) points, 26 (1.78) points at 24 hours postoperatively and 25.03 (2.29) at 48 hours postoperatively, for the group FB. The control group values illustrated in Fig. 4 showed an MMSE preoperative average score 26.48 (1.78), 25 (1.75) at 24 hours and 24.7 (1.17) points at 48 hours. Patients in group BF showed a very low need for rescue postoperative morphine. Opioid consumption was increased in group C average 3.7 (0.69) mg, median 4 mg compared with group FB average 0.50 (0.81) mg and a median of 0 ($p < 0.05$). It is accepted today that regional anaesthesia and analgesia result in beneficial effects in patients undergoing orthopaedic surgery (11). Given the importance of postoperative cognitive dysfunction in elderly surgical patients and its influence on patient's outcome, this study tried to find if regional analgesic technique, namely femoral block, induced prior to surgical procedure could influence the incidence of



early POCD.

Figure 3. Mini mental examination scores (MMSE) in group FB (femoral block).

Femoral trochanteric fractures have a huge incidence in aged people and results in increased costs and mortality (12). As an investigation tool MMSE gives an overview on the complex mental functions: cognitive status, exploring, memory, attention, executive functions and learning, globally (13). In the present study we registered early POCD as compared with the preoperative mental status as assessed with MMSE, considering a MMSE score of 23 as a cutting value for developing of delirium, and a difference of two points between examinations as a POCD. From the total of 75 patients who were eligible to this

study, 60 were randomized and 15 patients left the study (6 didn't met the inclusion criteria, 9 registered MMSE score <23). Overall incidence of POCD in our study was 60% a value in accord with the literature (1). In FB group the incidence of POCD was significantly lower than in control group 7% vs 52% ($p < 0.001$). In our study group C the incidence of POCD was high as compared to a recent study that showed an incidence of 15.9% (14), a difference that could be explained by the associated comorbidity in our patients, with the different assessment tool and with the enrollment of younger people. Postoperative 24-hour total morphine consumption was increased in group C as compared to group FB who registered an extremely low value ($p < 0.001$). This low rescue analgesic consumption of course has its own contribution to the lower incidence of POCD in group FB. In a recent systematic review on patients

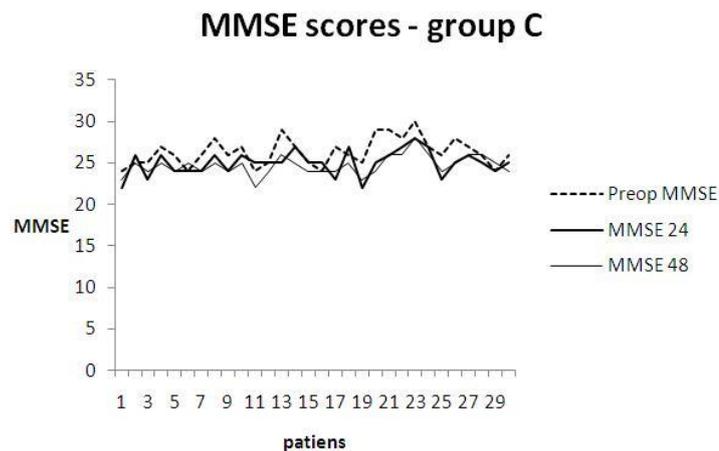


Figure 4. Mini mental examination scores (MMSE) in group C (control)

With joint arthroplasty surgery showed that the use of regional anaesthetic and analgesic techniques determine a lower incidence of POCD as well as the fact that the higher postoperative opioid consumption goes to a higher incidence of POCD (15). Femoral nerve block proved safety and effectiveness in the postoperative management in our study and didn't show side effects. This study has several limitations: lack of sample size calculation, also our simply research on POCD did not differentiate which functions are specifically altered, and provided only the global assessment of the mental status. Also this evaluation could be operator- dependent and could raise bias on the objectivity of data. Further studies with larger sample size are necessary to confirm the utility of this facile and safe analgesic technique in preventing postoperative POCD in aged patients with trochanteric fractures

Conclusion: Preoperative femoral nerve block appears to reduce the incidence of early POCD in patients scheduled for trochanteric surgery in spinal anaesthesia.

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ა.პ.ონუტუ, ე.ფატნიცი

**ბარძაყის ნერვის ბლოკადის გავლენა ტროხანტერზე წარმოებული ოპერაციის შემდგომი დისფუნქციის გამოვლენაში.
(კლუჯ-ნაპოსა, რუმინეთი-ჩისინაუ, მოლდოვეთის რესპუბლიკა)**

შესწავლილია ბარძაყის ნერვის ბლოკადის გავლენა ტროხანტერზე წარმოებული ოპერაციის შემდგომი პერიოდის დისფუნქციის აღმოცენებაში. გამოტანილია დასკვნა, რომ ოპერაციის წინა პერიოდში წარმოებული ბარძაყის ნერვის ბლოკადა ხელს უშლის ამგვარი დისფუნქციის გამოვლინებას.