COMBINATION OF PSOAS COMPARTMENT AND SCIATIC NERVE BLOCKS VS SPINAL BLOCK FOR INTERTROCHANTERIC FRACTURE SURGERY

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Abstract

Background: In this study, we examined the feasibility and efficacy of the combination of sciatic nerve block (SB) and Psoas compartment block (PCB) in the perioperative management of intertrochanteric fractures in elderly patients.

Methods: This is a prospective randomized study of 50 consecutive patients diagnosed with a femoral intertrochanteric fracture. Twenty-five patients received spinal anesthesia and twenty-five patients received sciatic and psoas block. Standard monitoring was applied. Time for performing the blocks, time to achieving block, operation time, time to the first request for analgesia and the fluid needs were calculated and compared between the two groups.

Results: Demographics according to ASA physical status, age, sex, and weight were not significantly different between the two groups. The duration for performing the spinal anesthesia (3.7 min) was significantly shorter but the average postoperative time (13 hours) before the first dose of analgesic was significantly longer when PCB and SB were performed. The blood pressure remained stable and the fluid needs were minimal in the patients who received the block. The main postoperative anesthesia-related complications were similar between the groups.

Conclusion: Combination of PCB and SB may result in less sympathetic involvement than spinal anesthesia and may be considered safe in patients with cardiovascular compromise.

Introduction

Intertrochanteric fractures represent one of the most common emergency orthopedic procedures performed. They are extra-capsular fractures of the proximal femur between the greater and the lesser trochanters, occasionally extending to a level of about 5 centimeters below the lower border of the lesser trochanter. These fractures are often seen in frail older people after a low energy fall[1]. Most of these patients are likely to have multiple comorbidities in the form of respiratory, metabolic or cardiac diseases. Therefore such patients have higher morbidity, mortality

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and postoperative disability rates[2,3].

Pain, both before and during the first 24 hours of surgery, is usually reported as severe by most patients. Those who report more severe pain after surgery experience longer hospitalization periods and greater delays until mobilization[4]. Providing post-operative pain relief in elderly patients with substantial amounts of opioids and anti-inflammatory agents may pose risks in this age group, such as central respiratory drive depression, mental confusion, gastrointestinal haemorrhage and renal dysfunction[5].

The choice of anesthesia for these patients has been an issue of continuing debate. It has been hypothesized that the superiority of regional anesthesia such as spinal, epidural, or neural blockade lies in the lack of need for intubation and mechanical ventilation[6], which is associated with increased respiratory morbidity[7]. Furthermore, regional anesthesia has the added advantage of being able to provide better postoperative analgesia and thus faster recovery[8]. On the other hand, spinal or epidural anesthesia may be associated with complications like urinary retention, delayed anal exhaust, nausea and vomiting, hypotension, respiratory inhibition, neurological damage, and epidural hematoma[9]. In this study, we examined whether peripheral nerve blocking may be used as an alternative form of regional anesthesia for elderly patients with intertrochanteric fractures, since peripheral nerve blocking is associated with less disruption to the circulation and fewer perioperative complications[10,11].

Methods

This is a prospective randomized study of 50 consecutive patients diagnosed with a femoral intertrochanteric fracture who presented to "Koutlibaneio & Triantafylleio" General Hospital of Larissa that started on 20/06/2014 and ended on 20/02/2015. The study was approved by the Ethics Committee of our institution and all patients provided an informed consent form. Inclusion criteria were adult patients over 65 years of age with a recent intertrochanteric fracture. Exclusion criteria were multiple fractures, peripheral neuropathy, bleeding disorders and allergy to local anaesthetics. All surgeries were performed by the same surgeon (PGT) using the same operative technique. Twenty-five patients received spinal anesthesia (Group A) and twenty-five patients received Psoas compartment block (PCB) and Sciatic nerve block (SB) (Group B), by the same anaesthesiologist (NF). The type of anesthesia was randomly assigned to each patient based on the output of a research randomizer at the beginning of the study.

All the patients were monitored with electrocardiography, pulse oximetry, invasive or non-invasive blood pressure measurements, and qualitative End tidal CO_2 monitor. Patients were administered supplemental oxygen (5 L/min) via a face mask and midazolam (0.025 mg/kg) as pre-medication. Before the introduction to anesthesia an infusion of 200 ml of lactated Ringer's solution was given.

Spinal anesthesia was performed with the patient lying in a lateral decubitus position with the affected side in the nondependent position, and with the lower thigh flexed upon the abdomen, and the neck flexed to a "forehead-to-knee" position. A 25G Quincke spinal needle was inserted at the selected intervertebral level (L3-L4 or L4-L5) and a combination of 1mL lidocaine 1%, 2mL levobupivacaine 0,5% and 10μg fentanyl was injected.

The PCB was performed with the patient lying in a more relaxed lateral decubitus position with the affected side in the nondependent position. A 4-in, 21-gauge insulated stimulating needle (Pajunk®, Geisingen, Germany), connected to a nerve stimulator (Pajunk®, Geisingen, Germany) was used. The intercristal line was marked. After skin infiltration, the needle was advanced perpendicularly to a point that lies 3 cm distally to the intercristal line and 4 cm away from the midline towards the affected side (modified Pandin approach)[12]. If the L4 spinous process was encountered, the needle was redirected cephalad or caudad. When the needle entered the psoas compartment (70-90 mm), a quadriceps motor response accompanied by patellar ascension was noticed. Adequate proximity to the nerves was assured by continued twitching after reducing the stimulation to 0.4mA. After aspiration to ensure that the needle was not within a blood vessel, 1mL of lidocaine 1% was injected. If slight motor activity was still witnessed, 10 mL of lidocaine 1% and 30 mL of ropivacaine 0.375% were administered[11].

The SB was also performed in the lateral decubitus position, with the hip slightly rolled forward and with the knee flexed to a 90° angle (Sim position). In order to find the point of needle insertion a line was drawn from the posterior superior iliac spine to the midpoint of the greater trochanter; from the middle of that line, a second line was drawn and extended caudally for 5cm, perpendicular to the first[13]. After skin infiltration, the same 4-in, 21-gauge insulated stimulating needle was used, in a direction perpendicular to the skin. Once a motor response was observed at the level of the ankle or foot, the stimulating current was reduced to 0.4 mA. After aspiration to ensure that the needle was not within a blood vessel, 1mL of lidocaine 1% was injected. If slight motor activity was still witnessed, 10 mL of lidocaine 1% and 20 mL of ropivacaine 0.375 % were administered[11]. The patient was then turned in a supine position.

Once pain free, the patient was placed on a traction table and closed reduction was performed under an image intensifier. Occasionally, in fractures of greater comminution in which closed reduction was deemed unsatisfactory, open reduction was performed. A modified mini lateral approach was used with an 8 to 10 cm long incision distal to the level of the trochanteric ridge. The skin, fascia lata and muscle were split in one line and a standard Compression Hip Screw (HipLOC, Bridgend, Biomet UK Ltd) technique was performed. For stable fractures a 3-hole plate was used, while for unstable fractures a 4-hole plate was used.

For the evaluation of each technique, the following parameters were measured: length of time for performing the blocks (time between beginning of prep. & drape until withdrawal of the needle), time to achieving the block (time between withdrawing the needle and reduction of the patient's pain), level of anesthesia, intra-operative blood pressure, heart rate and fluid requirements, surgical time (min), blood loss (assessed by a blood collection bag, as well as pre- and post-operative hematocrit and hemoglobin levels), renal function (by pre- and post-operative creatinine levels), the main postoperative anesthesia related complications, including nausea, vomiting and anxiety and time to the first request for analgesia.

InStat software (Version 3.05, GraphPad Software, Inc.) was used for statistical analysis. With regard to the independent variables and research hypotheses, independent t-test and Mann Whitney U test were used to analyze the data, for parametric and non-parametric values respectively. A two tail P value less than 0.05 was considered statistically significant.

Results

There were not any statistically significant differences between the two treatment groups in terms of demographics (age, sex, weight), ASA physical status (Table 1), fracture severity as described by the Evans classification of intertrochanteric fractures (Table 2) and the mean waiting time before surgery (Table 1). Out of the 50 patients, 10 had a history of diabetes mellitus, 44 had a history of hypertension and 14 had heart failure. The time for performing and the time for achieving anesthesia were significantly shorter in Group A (Table 3).

Table 1

Demographic characteristics of patients receiving spinal anesthesia (Group A) or peripheral blocks anesthesia (Group B)

	Group A (n=25)	Group B (n=25)	P value
Gender (M/F)	599/20	5/20	*0.99*
Age (years)	83.6	84.3	*0.73*
ASA I	0	0	*0.06*
ASA II	13	9	
ASA III	9	5	
ASA IV	3	11	
Weight (Kg)	63.1	70.4	*0.13*
Days to surgery	4.9	5.4	*0.64*

Table 2

Evans classification of intertrochanteric fractures.*

Evans Classification	Group A (n=25)	Group B (n=25)	P value
I	1	0	0.189
II	6	3	
III	4	4	
IV	10	11	
V	3	7	
R	1	0	

** The higher the value the more comminuted and unstable the fracture.*

Table 3
Average time for performing anesthesia, achieving anesthesia, requesting analgesia, operation time and fluid needs

	Group A (n=25)	Group B (n=25)	P value
Average time performing the blocks (min)	3.7	17.5	< 0.0001
Average time achieving the blocks (min)	2.6	17.5	< 0.0001
Average operation time (min)	52.5	55.5	0.431
Average time post-op before 1st analgesia dose (h)	2.9	13	< 0.0001
Fluid needs (ml)	1980.8	657.69	< 0.0001

The spinal block was successful in all cases. The combined PCB and SB anesthesia was successful in all cases except one, where there was some discomfort with deep tissue handling and additional sedation with low doses of iv fentanyl was administered. However the procedure continued and the patient retained the postoperative analgesic effect.

Patients in Group A had a statistically significant decrease in blood pressure after spinal anesthesia (Table 4) and had greater fluid needs perioperatively (Table 3), compared with patients in Group B. The average time to the first request for analgesia (Table 3) postoperatively was 13 hours in Group B and 2.9 hours in Group A, which was also statistically significant. As far as surgical time (Table 3), blood loss, postoperative anesthesia-related complications and renal function (Table 5) were concerned, no statistically significant differences were found between the two groups.

Table 4
Comparison of hemodynamic parameters before and after lumbar plexus and sciatic nerve block and spinal anesthesia

	Group A	Group B
Mean arterial pressure post-anesthesia (mmHg)	76.577	83.5
Difference (mmHg)	19.154	1.654
P value	< 0.0001	0.2145

Table 5
Estimated blood loss, postoperative transfusion, and kidney function by means of hematocrit and hemoglobin values

	Group A (n=25)	Group B (n=25)	P-value
Pre-operative hematocrit	34.2	32.1	0.302
Post-operative hematocrit	29,1	28.9	0.888
Pre-operative hemoglobin	11.3	10.6	0.303
Post-operative hemoglobin	9.8	9.6	0.692
Blood Units transfused	0.9	0.7	0.486
Pre-operative creatinine	1.28	1.27	0.596
Post-operative creatinine	1.31	1.37	0.79

While the difference in the ASA physical status (Table 1) was not quite significant, there were a higher number of ASA IV patients in the peripheral block group.

There were no complications related to either form of anesthesia during the procedure, or throughout the first 24 hours post operatively.

The anesthesia was considered adequate in all cases, and all the operations were completed successfully. All the patients were discharged from the hospital after 7-10 days, except one patient from Group B, who died on the fourth day after surgery.

Discussion

In this study we compared the intraoperative anesthesia management and the postoperative pain control of two different regional anesthesia methods. Spinal anesthesia is considered as a method of choice in lower extremity operations, despite the major hemodynamic changes and fluid shifts, due to extensive sympathetic block. There is, however, room for concern, especially in patients with cardiovascular compromise. Combined PCB and SB may be accompanied by less sympathetic involvement

because of the unilateral approach and the somatic dominant effect[14]. In our study, patients in Group B had a stable mean arterial pressure during surgery and received significantly less fluids and vasopressors, compared with patients of Group A, which indicates that combined PCB and SB may be considered safer in patients with cardiovascular compromise. Other studies have also reported more stable hemodynamics with PCB when compared with general and neuraxial anesthesia[15].

During surgery, sufficient muscle paralysis is of great importance in the reduction of fractures, particularly in densely muscular regions, and may be evaluated by surgeon satisfaction. PCB and SB provided sufficient relaxation, comparable to spinal anesthesia, according to the surgeon's satisfaction. In addition, the duration of analgesia with peripheral nerve blocks was much longer than spinal anesthesia. Specifically, patients who received PCB and SB started to feel pain at a mean of 13 hours after the end of the operation, while patients who received spinal anesthesia were in need of analgesics at a mean of 2.9 hours after the end of the surgery.

It has been shown that neuraxial blocks have a clear and definite effect on surgical blood loss and, although this is not always the case, this effect led to a reduction in the number of blood transfusions in patients undergoing total hip replacement and spinal fusion[16]. In our study, patients who underwent PCB and SB had similar blood loss, similar decrease in hemoglobin and hematocrit values, and similar need for transfusion as in the case of spinal anesthesia.

There is evidence from controlled laboratory studies that pain can impact on cognition and thus might precipitate delirium, particularly in hip fracture patients. The fact that PCB and SB provided sufficient analgesia during surgery and many hours later, leads to better delirium outcomes[17,18].

Over the years, numerous approaches have been described for the PCB[18]; however there has been no significant difference in clinical efficacy between these approaches. The main difference has been in the side effects. The L3 approaches and the approaches with a more medial insertion point have been described as having the highest complication rates. The most frequently occurring side effect is the epidural diffusion of the injected local anesthetics[19,20] which is associated with a medial needle point insertion, a more cephalad approach, and a large injected volume. Retroperitoneal hematoma has been described in patients receiving anticoagulants or antiplatelet drugs[21]. Renal subcapsular hematoma has also been described after an L3-PCB, since the inferior renal pole is close to the L3 level, suggesting that an L4 approach should be safer[22]. The most serious complication of a PCB is the inadvertent intravascular injection of cardiotoxic local anaesthetics, rapidly leading to such acute toxic reactions as seizures, cardiac arrest and eventually death[15]. In our study we have not encountered any serious complications because our injection point was at the L4 level and slightly more lateral than the original method by Pandin[12], despite the relatively high volume of anaesthetics. There was a strict adherence to the recommended guidelines for anticoagulants and neuraxial blocks, which led to delaying the operation for a full week. Aspiration prior to injection, a negative test dose and a slow fractionated injection have been implemented to prevent inadvertent intravascular injection, as described in the literature[22].

There are not many reports in the literature that study the combined PCB and SB compared to spinal anesthesia for intertrochanteric fractures of the hip, and the results of the few that exist are contradictory. In 2000, Morin et al.[15] performed a prospective randomized study to determine the hemodynamic effects and quality of combined lumbar and sacral plexus block compared with plain bupivacaine spinal anesthesia in the elderly for repair of proximal femoral fractures. They concluded that both provided adequate anesthesia for repair of hip fracture in the elderly. However hypotension was induced by both the combined peripheral nerve block and plain bupivacaine spinal anesthesia. In 2002, Ho and Karmakar[23] reported the use of a combined paravertebral lumbar plexus and sciatic nerve block for reduction of hip fracture in an elderly patient with severe aortic stenosis. The anesthesia was successful, however the authors used a moderate amount of phenylephrine to maintain adequate systemic blood pressure, despite the largely unilateral nature of the blocks. In 2005, Shimoda e al.[24] reported combined paravertebral lumbar plexus and parasacral sciatic nerve block for reduction of hip fracture in four patients with severe heart failure.

The anesthesia was successful without any sequelae. In 2006, Bekker et al.[25] described a case report of the first successful ultrasound-guided lumbar plexus block on a 91-year-old woman with aortic stenosis who successfully underwent open reduction and internal fixation of a fractured right hip with a lumbar plexus block. Ultrasound provided direct visualization to help identify the anatomical structures and guide the block needle during performance of the block. Complete block of the lumbar plexus was attained within 15 min, and the surgical procedure was performed uneventfully.

An exciting advance that has taken place over the past few years is ultrasound guidance in regional anesthesia. Ultrasound imaging techniques optimize the needle position of this deep peripheral nerve block. Advantages of this include a higher success rate, shorter onset time, lower injected volumes of local anaesthetics, all of which should render the rate of complications very low[26,27,28].

A limitation in our study is the sample size, which is not large. On the other hand it is a prospective randomized study in which we made an effort to answer as many questions as possible on the feasibility and efficacy of the combination of PCB and SB in the perioperative management of intertrochanteric fractures in elderly patients, as well as to investigate whether it is at least as effective an anesthesia technique as spinal anesthesia is.

In conclusion, the combination of PCB and SB seems to be effective as a locoregional technique for anesthesia for the intertrochanteric fracture fixation. It is also an effective form of postoperative analgesia, for at least the first 12 hours after the procedure. The hemodynamic stability that it offers during the operation and the reduced need for high volumes of fluid make it an ideal form of anesthesia for patients with cardiovascular compromise. Analgesic potency is similar to epidural analgesia without the undesirable side effects. Ultrasound imaging techniques could be helpful to optimize the results of this deep peripheral nerve block. Further studies could be of great value.

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