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Research Article

Continuous spinal anesthesia versus single small dose bupivacaine–fentanyl spinal anesthesia in high risk elderly patients: A randomized controlled trial

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KEYWORDS

Elderly;
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Abstract *Background:* Greater numbers of patients are presenting for surgery with aging-related, pre-existing conditions that place them at greater risk of an adverse outcome. Hemodynamic instability due to high sympathetic block largely limits the use of conventional dose spinal anesthesia in high risk elderly patients. In this study we aim to compare the hemodynamic stability and the incidence of hypotension in continuous spinal anesthesia (CSA) versus single low dose spinal anesthesia (SD) in elderly high risk patients.

Methods: This prospective randomized blinded study was carried on 34 ASA III & IV elderly patients aged >75 years undergoing orthopedic lower limb surgery. The patients were randomly assigned to one of the study groups. Group CSA received intermittent dosing of local anesthetic solution via an intrathecal catheter using 0.5 ml of 0.5% isobaric bupivacaine increments and 0.5 ml of fentanyl (25 μg) while group SD single dose of 1.5 ml of 0.5% isobaric bupivacaine and 0.5 ml of fentanyl (25 μg). The study groups were compared regarding hemodynamic stability, incidence of hypotension and total ephedrine consumption.

Results: Incidence of severe hypotension was significant. 52.9% of patients in SD group experienced an episode of severe hypotension versus none of them in CSA group (p 0.033*). Total dose of fluids infused was significantly more in the SD group. The use of ephedrine was significantly more in SD group.

Conclusion: CSA provided fewer episodes of hypotension and no severe hypotension versus SD 7.5 mg bupivacaine. CSA offers the added advantage of the ability to titrate dose of local anesthetic as needed while maintaining hemodynamic stability.

1. Introduction

Greater numbers of patients are presenting for surgery with aging-related pre-existing conditions, which places them at greater risk of an adverse outcome, such as cardiac or

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pulmonary disease or diabetes mellitus [1]. No single anesthetic technique or agent appears to have universal advantage for the elderly surgical patient with regard to survival [2]. Spinal anesthesia is a widely used anesthetic technique in lower limb surgery in the elderly due to its rapid onset, minimal effect on mental status and reduction in blood loss [3]. Hemodynamic instability due to high block largely limits the use of conventional dose spinal anesthesia in high risk elderly patients [4]. Hypotension is more common, and also more hazardous, in elderly patients, as they may have decreased physiological reserve and compromised blood supply to various vital organs [5]. A smaller dose of local anesthetic reduces the severity and incidence of hypotension during spinal anesthesia [6,7]. To reduce the adverse hemodynamic effects associated with the spinal anesthesia-induced medical sympathectomy, combinations of very small doses of local anesthetic and adjuvant opioids are frequently administered [8].

Continuous spinal anesthesia (CSA) is an underutilized technique in modern anesthesia practice. Compared with other techniques of neuraxial anesthesia, CSA allows incremental dosing of an intrathecal local anesthetic providing fewer hemodynamic alterations [9]. The technique lost popularity following a number of case reports of cauda equina syndrome associated with continuous spinal anesthesia and the use of microcatheters. An FDA investigation leads to withdrawal of approval of microcatheters smaller than 24 G for intrathecal route. Nerve injury is attributed to mal distribution of local anesthetic as microcatheters have a limited flow rate [10,11]. A recent retrospective study was conducted on 1212 patients who underwent surgery of the lower extremities with continuous spinal anesthesia using 28-gauge microcatheters. No major complications were observed in any of these patients [12].

Our primary goal was to compare the incidence of hypotension in continuous spinal anesthesia (CSA) versus single low dose spinal anesthesia (SD) in elderly high risk patients. Our secondary goal was to compare the vasopressor consumption between the study groups.

2. Methods

This prospective randomized blinded parallel study was carried on 34 ASA III & IV elderly patients aged >75 years undergoing orthopedic lower limb surgery at El Hadera university hospital between January 2013 and September 2013, after obtaining written informed consent from patients and obtaining approval of the Alexandria university ethics committee. Patients suffering from intracranial hypertension, major bleeding disorder, patients on anticoagulant, local infection, dementia, or allergic reaction to local anesthetics, were excluded from the study. Patients received no pre-operative sedation and patients were off oral fluids for 6 h before surgery. Pre-loading was done using 500 ml voluven (6% hydroxyethyl starch 130/0.4 in 0.9% sodium chloride injection), and standard ASA monitors were applied. All patients received oxygen (3 L/min) by a face mask during the procedure; patients were allocated to either study group using a randomized central computer-generated sequence and a sealed envelope assignment held by an investigator not involved with the clinical management or data collection. Group SD (17) patients were turned to the lateral position with operative limb below. Subarachnoid puncture was performed with a 22-gauge Whitacre point needle at the L3–4 interspace by a midline approach under full aseptic technique. Injection of 1.5 ml of isobaric bupivacaine 0.5% and 0.5 ml of fentanyl (25 μg) was made over 10–15 s. Five min after completion of the injection the patients were turned to the supine position. Group CSA (20) patients were turned to the lateral position with operative limb below. Under full aseptic precaution 18 G Tuohy epidural needle was inserted into L3–L4 space using a midline approach. After obtaining free flow of cerebrospinal fluid a 20 G epidural catheter was threaded into the subarachnoid space 5 cm cephalad. 0.5 ml isobaric bupivacaine 0.5% and 0.5 ml of fentanyl (25 μg) injected intrathecally over 30 s through catheter and catheter was fixed in position. Patient turned to supine position after 5 min. A blinded observer assessed the level of the resulting sensory blockade using an ice cube bilaterally at one-minute intervals for the first five minutes and then at five-minute intervals until reaching 15 min. If sensory bock level T12 was not achieved within 15 min, incremental doses of 0.5 ml isobaric bupivacaine 0.5% were titrated every 15 min till reaching a maximum total dose of 1.5 ml isobaric bupivacaine. When adequate surgical anesthesia was not achieved general anesthesia was preformed and patient was excluded from study. During surgery, when the patients complained of discomfort 1 mg midazolam was administered intravenously.

Heart rate and non-invasive blood pressure were measured before local anesthetic injections (baseline), immediately after local anesthetic injection, immediately after turning to patient to supine position, 15 min after local anesthetic injection, and every 15 min thereafter assessed by an anesthesiologist, blinded to the treatment groups. Ringer's lactate was used for fasting replacement and hourly fluid.

2.1. Needs

Blood losses were replaced with voluven (6% hydroxyethyl starch 130/0.4 in 0.9% sodium chloride injection) at a 1:1 ratio. Hypotension was defined as a decrease of 20% from baseline; severe hypotension was defined as a decrease of 30% from baseline. Hypotension was treated with additional volume first 250 ml of lactated Ringer's solution over 10 min if hypotension persists, or if severe hypotension develops IV boluses of ephedrine 6 mg were repeated every 3 min.

Surgical procedure, highest level of sensory blockade, quality of motor blockade according to the Bromage scale (0 _ non-motor block; 1 _ hip flexion with extended leg blocked; 2 _ knee flexion blocked; 3 _ complete motor block), duration of surgery, total vasopressor administered, and the amount of fluid infused were recorded. Postoperative nausea and vomiting and postdural puncture headache (PDPH) were recorded during a 24-h period.

2.2. Sample size

Based on previous study on Spinal Anesthesia Using Single Injection Small-Dose Bupivacaine Versus Continuous Catheter Injection Techniques [9], assuming percentages of severe hypotension to be 8% in Group CSA and 51% in Group SD, at an alpha level 0.05, a minimum sample size