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Research Article

Continuous Spinal Anesthesia with Spinocath® Catheter. A Retrospective Analysis of 455 Orthopedic Elderly Patients in the past 17 years

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Abstract

Background and Objectives: Database analysis in general cost less and require less time as compared to large randomized controlled trials. This retrospective study with a catheter outside the cutting-tip needle for continuous spinal anesthesia for femur and hip surgery in elderly patients from 1998 to 2015, with the aim of determine possible advantages and disadvantages of this technique.

Methods: Anesthetic records of 455 patients receiving continuous spinal anesthesia over a 17-year period were analyzed retrospectively. All blockades were performed with patients in the left lateral position and by the two authors. Doses of 0.5% isobaric bupivacaine were administered according to the patient's height. Evaluated parameters were: puncture success, highest level of anesthesia, lower limb motor block, quality of anesthesia, need for additional doses, failures incidence, paresthesia, post-dural puncture headache, cardiovascular changes, mental confusion and delirium, blood transfusion and mortality.

Results: Seven patients were excluded for failure to puncture and accidental perforation of the duramater. The mean time for puncture and placement of the catheter was 2.66±1.03 min. The kit was easy to use in 376 patients and difficult in 42 patients. In all patients the catheter was inserted from 1 to 2 cm in the subarachnoid space. The mode of dispersion cephalad analgesia was T12. In 360 patients, the initial dose was sufficient to reach T12 and 88 patients required to supplement the dose. Mean isobaric bupivacaine initial dose was 7.74±1.78 mg and total dose was 8.58±2.60 mg. Hypotension occurred in 32 patients and bradycardia in 21 patients. Low intensity headache lasting for 3 days has been observed in seven patients. There has been no cauda equina syndrome or transient radicular irritation. Mental confusion occurred in 29 patients.

Conclusions: Our results with 455 patients over 17 years suggest that continuous spinal anesthesia with the catheter outside the needle for elderly orthopedic patient's shows minor insertion problem, a low incidence of hypotension, paresthesia and headache. No neurological complications were observed, such as cauda equina syndrome or transient neurological symptoms.

Keywords: Anesthetics; Local: Isobaric Bupivacaine; Anesthetic Techniques; Regional: Continuous Spinal Block; Surgery; Orthopedic

Introduction

With the appearance of microcatheters (calibers 28 to 32G) in 1990 there was a resurgence of interest in continuous spinal anesthesia (CSA) [1]. Microcatheters are difficult to handle, the appearance CSF is slow or impossible, injection of the local anesthetic is slow, can break and provide inadequate blocks due to poor anesthetic distribution hyperbaric in the subarachnoid space, which can cause cauda equina syndrome [2, 3]. In 1995, a new spinal anesthesia catheter was used in Europe [4]. This 22G and 24G

caliber catheter, 73 cm long, is mounted outside a spinal anesthesia needle caliber 27G and 29G, with Quincke point. It has terminal opening and only one side hole 0.5 cm from the tip, requiring only an inch of your length is introduced into the subarachnoid space. Three years after its initial use in Germany, it arrived in Brazil and one year after, the first article was published with this new catheter for CSA in 40 patients with orthopedic lower limb surgery, suggesting CSA with the catheter outside the needle shows minor insertion problems and a low incidence of hypotension [5].

Subsequently, we compared CSA with combined spinal-epidural anesthesia and sing shot spinal anesthesia (SSA) in a retrospective study [6] and compared with combined spinal-epidural anesthesia in a prospective study [7], provided good surgical conditions with a low mortality rate in the first postoperative month and to a low incidence of complications. And finally in 2006, we used it for labor analgesia with the 29G needle and 24G catheter set in five pregnant patients [8]. The catheter to perform CSA arrived in Brazil in 1998 and was discontinued in 2016 by the company that marketed it. In Brazil our group published several articles with the kit for CSA. Thus, we retrospectively assessed the number of CSA performed by our study group. Our objectives were to evaluate the use of CSA, its efficacy, ease to use and safety over the 17 year period.

Method

After obtaining institutional approval and informed consent from the subjects, this retrospective analysis was conducted the period from June 1998 to December 2015. All patients who submitted to femur osteosyntesis and partial or total hip replacement and received CSA carried out in this period were noted in an Excel spreadsheet designed for this monitoring and were reviewed. Patients' demographic profiles, ASA physical status, comorbidities and clinical outcome were noted in the Excel spreadsheet. Details of the CSA, performance parameters, duration of surgery, intraoperative hemodynamic status and the usage of vasopressor and atropine were obtained from the anesthesia records. Inclusion criteria are shown in (Table 1). Associated diseases and drugs in use were also recorded. No patient was premedicated. Monitoring in the operating room consisted of continuous ECG in CM5, non-invasive blood pressure and pulse oximetry. All patients had an upper limb vein punctured with an 18G venous catheter and a 3 L.min-1 oxygen catheter or Hudson mask installed. After venous puncture, patients were given intravenous midazolam (0.5-1 mg). To place the patient in the blockade position, 0.1 mg/kg dextroketamine IV were injected, or anterior plexus lumbar blockade was performed with 20 mL of 2% lidocaine with epinephrine 1:200.000 + 20 mL of 0.5% bupivacaine. In patients operated for partial or total hip arthroplasty, they received dextroketamine and posterior lumbar plexus block with 40 mL of 0.25% bupivacaine for postoperative analgesia. Using the previously described technique [5], the epidural puncture was paramedially performed in the left lateral position at L2-L3 or L3-L4 interspace with an 18G Crawford needle. After that, dura was punctured with a Spinocath® device (B. Braun Melsungen AG) with a 27G needle and 22G catheter set. With the patient still in the puncture position, 5 to 10mg of 0.5% isobaric bupivacaine was injected, depending on patient's height, when they were immediately placed in the supine position (Table 2). The following data were recorded: time taken for catheter insertion, perception of dural puncturing by spinal needle, difficulty of technique ("easy", "difficult", "impossible" or "perforation duramater"), highest level of sensory blockade, quality of motor blockade according to the Bromage scale, incidence of paresthesia, duration of the surgical procedure and neurologic complications. In case of pain or inadequate level, 2.5 mg of 0.5% bupivacaine were injected through the spinal catheter, until problem correction, which was removed at the end of surgery.

Table 1: Inclusion Criteria for Surgery.

1	More than 60 years of age
2	Physical status ASA I, II and III
3	No admitted to ICU
4	Absence urinary bladder catheter
5	No receiving low molecular weight heparin before surgery
6	No receiving spinal or epidural opiods
7	Peripheral nerve block for analgesia pre or postoperative
8	No history of mental confusion
9	Life compatible with age until fracture
10	Infection at the puncture site
11	Absence of preoperative hypovolemia

Table 2: Recommended used 0.5% Bupivacaine Isobaric Doses.

Height	Doses
< 150 cm	5 mg
Between 151 and 160 cm	7.5 mg
Height > 161 cm	10 mg
Additional dose	2.5 mg

If accidental dural puncture were to occur during attempts to use an epidural approach with Crawford or Tuohy needles, the catheter would have to be introduced into the subarachnoid space and such patients would be excluded from the study. In the event of failure to access the epidural space within 15 minutes, single-shot spinal anesthesia would be administered with 15 mg of 0.5% isobaric bupivacaine and such patients would be excluded. All anesthesia's were performed by or in the presence of the two authors (LEI, MAG). Hypotension (defined as a 30% decrease in systolic blood pressure, in comparison with preoperative control levels) was treated with ethylphenylephrine 1 mg intravenously. Bradycardia (defined as HR less than 50beats/min) was treated with atropine 0.5 mg intravenously. The patients were followed up by telephone regarding the appearance of cauda equina syndrome or transient neurological symptoms. The results were evaluated by the descriptive analysis of studied variables (frequencies,

percentages, scatter plots and concentration ellipses) and, when possible, by the mean and standard deviation

Results

Four hundred and fifty-five underwent patient's surgery using CSA during 17 years of the studied period. Of these, 298 (65.9%) were females. All of these CSA were carried out by the two authors. The 27G needle and 22G catheter were used in all patients. Only seven patients had to be excluded because of unintended dural perforation with the epidural needle in two patients or failure to access the epidural space with the Crawford needle in five patients. Demographic data are shown in (Table 3) and (Figure 1). The different doses used in the 448 patients are shown in (Table 4). Mean isobaric bupivacaine initial dose was 7.74±1.78 mg and total dose was 8.58±2.60 mg. The time to perform CSA was 2.36±1.03 minutes and the duration of surgery was 2.17±0.82 hours. In 376 patients, epidural puncture with Crawford needle was easy; in 72 patients it was difficult. The subarachnoid catheter was inserted easily in 407 patients and with difficulty in 42 and in all patients the catheter was inserted only 1 to 2 cm in the subarachnoid space. Paresthesia was observed in only 27 patients. In the seven patients where there was accidental perforation of the dura mater or failure to identify the epidural space, simple spinal anesthesia was performed with 15 mg of 0.5% isobaric bupivacaine (Table 5).

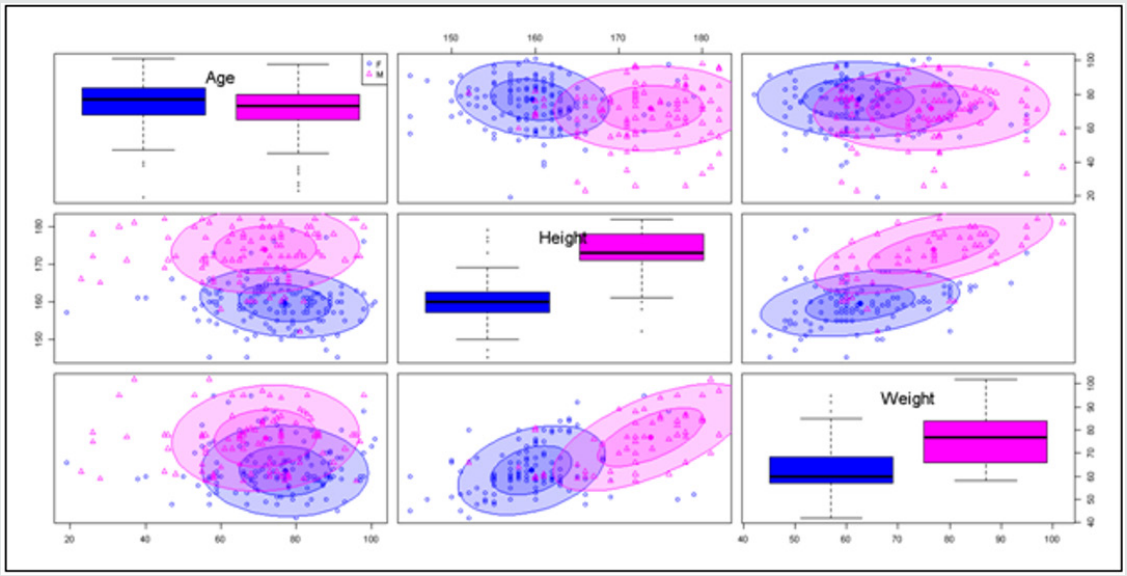

Figure 1: Age, weight and height distribution in 455 patients.

Table 3: Demographics Data.

Age (years)	**74.03±13.22**
Weight (kg)	67.57±12.68
Height (cm)	164.26±8.64
Gender: Male/Female	298 / 157
Physical status: ASA I / II / III	9 / 425 / 21

Table 4: The different doses used in the 448 patients and mean ± SD.

Recommended Doses	Number Of Patients
5 mg	94
7.5 mg	217
10 mg	137
Initial Dose (Mean±DP)	7.74±1.78 mg
Total Dose (Mean±DP)	8.58±2.60 mg

The cephalic dispersion of anesthesia was observed between T12 and T5 and the mode obtained was in T12 (Table 5). In 360 patients, the dose programmed according to height was sufficient to perform the procedure. There was a need for a supplementary dose in 88 patients due to the level and/or insufficient time to perform the surgery. Maximum motor block (Bromage 3) was observed in 340 patients. The initial degrees of motor block are shown in (Table 5). Arterial hypotension was observed in 32 patients (7.1%) and bradycardia in 21 patients (4.6%) who required treatment with vasopressors and atropine. Low-intensity headache and lasting three days was observed after CSA in seven patients (1.5%). Twenty-nine patients presented postoperative mental confusion. All catheters were removed at the end of the surgery and there was no presence of CSF in the dressing. There was no case of cauda equina syndrome or transient neurological symptoms. Most patients had multiple comorbidities. The most common comorbidities are hypertension (48%), diabetes mellitus (22%), moderate kidney disease (7%), chronic pulmonary disease (9%) and congestive cardiac failure (5%). Fourteen Jehovah's Witnesses' patients participated in the study, no need for blood transfusion.

Table 5: Spinal anesthetic characteristics in orthopedic surgery in 455 Patients.

Characterists	CSA
Performance time (minutes)	2.36±1.03
Duration of surgery (hours)	2.17±0.82
Excluded patients	7 (1.6%)
- Accidental perforation DM	2 (0.4%)
- Puncture unsuccessful	5 (1.2%)
Epidural puncture	448
- Easy	376 (83.9%)
- Difficult	42 (16.1%)
Catheter insertion	448
- Easy	407 (90.8%)
- Difficult	42 (9.2%)
- Paresthesia	27 (6.0%)
Sensory level	448
- T12	144 (32.2%)
- T11	111 (24.8%)
- T10	113 (25.2%)
- T9	43 (9.5%)
- T8	19 (4.3%)
- T7	11 (2.4%)
- T6	5 (1.2%)
- T5	2 (0.4%)
- Mode	T12
Motor block	448
- Grade 3	340 (75.8%)
- Grade 2	108 (24.2%)
- Grade 1	0
- Grade 0	0

Discussion

This retrospective study has shown that for femur and hip surgeries in elderly patients, CSA with catheter designed for this procedure provides less cephalad dispersion (mode T12), lower incidence of arterial hypotension and less local anesthetic requirement, without any neurological complications. The failure rate was low (1.5%) and need for complementation of the initial dose of 19.6%. Femur and hip fractures are major issues for health services. Incidence increases with age, with predominance of women due to association to osteoporosis. In our study, this was confirmed by the 65.9% presence of women in the groups. The utilization rate of CSA technique only in elderly patients with hip or hip fracture by our group for 17 years averaged 30 patients per year [5-7]. In 2006, we used the set (24G catheter and 29G needle) for labor analgesia in five parturients, with excellent results [8]. In 2016 we stopped using CSA with Spinocath® has been discontinued from the market.

In a previous study comparing CSA with continuous epidural anesthesia (CEA), the time to perform it was significantly shorter with CSA (2.6±0.9 min) than with CEA (2.9±1.2 min) [7]. In this retrospective study with 448 patients, the time to perform the CSA was shorter (2.36±1.03 min) than that obtained in the previous article. Using the same kit for CSA (n=50) compared to CEA, the performance time was significantly longer with CSA (6.09±2.20 min) and practically three times that obtained in our studies [9].

In most of our patients, they received an inguinal lumbar plexus block before CSA. For this reason, we do not evaluate the latency time of the first dose of 0.5% isobaric bupivacaine. In a study comparing CSA versus CEA, the time to reach sensory level T10 was significantly lower with CSA (8.40±3.96 min x 18.80±6.59 min) [9]. Sensory block level and motor blockade may be easily obtained and controlled with CSA, in the same way allows early recognition of insufficient level or insufficient time for the surgical procedure. Because of the incremental doses in 19.6% of the patients, either to produce the required analgesia or to extend analgesia, it would be useless to study the final dermatome level of analgesia. CSA was introduced in 1907 [10]. It is a well-established technique that has been used successfully in orthopedic surgical procedures [5-7]. The technique allows titration of the local anesthetic dose according to surgical needs and provides safe anesthesia, particularly for elderly or high-risk patients with unstable hemodynamic status [5, 11]. CSA depends on how the catheter is introduced into the subarachnoid space. It is more difficult when a microcatheter is used [1-3]. We found difficulties during catheter insertion in 9.2% of the patients in the CSA group, an incidence 3.6 times higher than in a previous study [7]. In three studies comparing CSA with CEP, it showed a significantly lower dose in the CSA group [6, 7, 9]. The total mean dose of 0.5% isobaric bupivacaine was similar in the three studies and practically the same in this group of 448 patients (8.58±2.60 mg).

In a recent study, it was found that CSA took longer with a Spinocath® with 29G Quincke needle and 24G catheter (6.3±3.2 min) than with a microcatheter 22G Sprotte needle and 27G catheter (3.9±1.2 min) [12]. This time was 2.6 times longer than what we found in our study, using the Spinocath® with 27G Quincke needle and 22G catheters. It is well known that the time taken for cerebrospinal fluid to flow through a 29G needle with Quincke bevel (80.45 seconds) is three times longer than through a 27G needle (27.21 seconds) [13]. The use of different types and sizes of needles may explain this difference. Some studies used the CSA for post-operative analgesia for abdominal, vascular, hip surgery [14] and severe aortic stenosis with hip fracture [15]. Because we used lumbar plexus block (anterior and posterior) with neurostimulator, the use of CSA for postoperative analgesia was not practiced in our routine and all catheters were removed at the end of surgery. CSA using small titrated dose provides better hemodynamic stability than SSA [6] and CEA [6, 7] in elderly orthopedic patients. Although transoperative hypotension (7.1%) may occur, it was easily treated with small doses of vasopressors without any major adverse event reported. Because it has a larger diameter than the needle 27G and the catheter 22G occludes the duramater orifice and prevents CSF loss and develops a reaction with fibrin deposit at the puncture

site, which has already been shown to be animal [11]. There was no presence of CSF in the dressing during the removal of the catheter from the subarachnoid space. The direction of the catheter introduced into the subarachnoid space cannot be predicted. In this work, with professionals over 45 years of practice and introduction of less than 2 cm of the catheter, a 6% incidence of paresthesia was observed. Post dural-puncture headache (PDPH) is a commonly reported complication of spinal anesthesia. A decrease in the size of the puncture needle and an increasing age of the patient are thought to reduce its incidence, but also factors such as thickness of the dura, a thicker dura tends to retract more rapidly than thin dura and gender of the patient, females have a higher incidence, are to be taken into consideration [16]. In a 1999 study with a catheter outside the needle, there were two patients with mild post dural-puncture headache after CSA, who did not require any invasive therapy, and two patients who received a blood-patch [11]. In another study with the same kit for CSA in 50 patients, no case of PDPH was observed [**9]**. In our study with 448 patients, PDPH was observed in only 7 patients (1.5%) of medium intensity and short duration (3 days). Postoperative urinary retention is a common event following surgical procedures. As criteria for inclusion in the study, patients who had a bladder catheter were automatically excluded from the study. Likewise, no patient received opioids subarachnoid ally and analgesia was performed with lumbar plexus block. In this study, only 1.7% of patients needed a urinary catheter during the postoperative period.

Conlusion

The main advantage of CSA is the possibility to gradually inject the local anesthetic and control dispersion in the CSF, providing security and control over the needs of each patient. This objective was achieved in this study. The frequency of headache with this technique and in this age group is very low. No serious neurological complications were observed, especially cauda equina syndrome. Thus, we can say that CSA when correctly used with a catheter outside the needle is a safe technique, especially in elderly patients with hip or hip fractures. The CSA with high doses of hyperbaric anesthetics through the catheter outside the needle, poor distribution was not observed or risk of cauda equina syndrome were not observed. [17] Unfortunately this catheter was discontinued by the manufacturer and we anesthetists have lost an excellent product in our therapeutic arsenal.

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