European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 07, 2022

A PROSPECTIVE RANDOMIZED STUDY ON CONTINUOUS SPINAL ANESTHESIA VERSUS COMBINED SPINAL EPIDURAL BLOCK FOR ABDOMINAL ONCOLOGICAL SURGERY

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Abstract

Background - Continuous spinal anesthesia (CSA) offers considerable advantages over "singleshot" spinal or epidural anesthesia since it allows administration of well-controlled anesthesia using small doses of local anesthetics and a definite end point with less failure rate. The combined spinal–epidural technique (CSE) involves intentional subarachnoid blockade and epidural catheter placement during the same procedure. CSE allows a rapid onset of neuraxial blockade, which can subsequently be prolonged or modified. **Study detail -** Here we planned a prospective randomized study on continuous spinal anesthesia versus combined spinal epidural block for abdominal oncological surgery. Informed consent was obtained from the subjects and institutional approval was obtained before random and prospective studies of 50 patients who were scheduled for abdominal oncological surgery. **Results and outcome** - Our results suggest that both CSA and CSE provided good surgical conditions with low incidence of complications. CSA provided better cardiovascular stability with a smaller dose of local anaesthetic and shorter onset time, and without failures. We used epidural needle for CSA as it is cost effective and the technique is easy.

Keywords - combined spinal–epidural technique, Continuous spinal anesthesia, epidural needle

Introduction

Cancer is a leading health problem worldwide. According to epidemiological data, approximately 40% of people have a chance to develop cancer during their lifetime. Chemotherapy, radiotherapy, and surgery are techniques for cancer treatment with different side effects on the human body [1]. To prepare the best preoperative, intraoperative and postoperative management plans for patients with a history of cancer, the knowledge of long-term and acute side effects caused by these methods of treatment is required of anaesthesiologists. In addition, anaesthesiologists play a major role in the analgesic management of the disease for patients in severe pain[2].

Until recently, focus on the anesthetic management of cancer patients has been limited. Relatively small alterations in the perioperative anesthetic management may play a tremendous role in tumor progression. Optimizing anesthesia to reduce the surgical stress response could improve recurrence rates and long-term outcomes for cancer patients by inhibiting perioperative metastasis formation[3]. Regional anesthesia and amide local anesthetics are suspected to calm the immunologic storm of prostaglandins, catecholamines and cytokines when used in the perioperative phase.

Furthermore, volatile inhalational anesthesia is thought to modulate the immune system in a pro-cancerous way, while propofol may have opposite effects. Many of these recent studies are statistically underpowered and susceptible to bias, and experts in cancer treatment and anesthesia have emphasized the need for further research within this specific field[4].

The most common regional techniques are spinal and epidural anesthesia, and both of these offer the advantage of having a catheter available for extending the blockade during surgery and for achieving versatile pain therapy during the postoperative period. Combined spinal epidural anesthesia (CSE) involves intentional subarachnoid blockade and epidural catheter placement . Continuous spinal anesthesia (CSA) is a technique for producing and maintaining spinal anesthesia with smaller doses of local anesthetic that are injected intermittently into the subarachnoid space via an indwelling catheter[5].

In this study the investigators aim to characterize the blockading properties and side effects of CSA were compared among patients scheduled for abdominal oncological surgery.

Materials and Methods

Informed consent was obtained from the subjects and institutional approval was obtained before random and prospective studies of 50 patients with ASA - III(according to the American Society of Anesthesiologists) who were scheduled for abdominal oncological surgery.

Randomization was conducted using a computer-generated schedule and coded envelopes. CSA patients were assigned to group 1 and CSE patients to group 2. After one of the authors administered the anesthesia (CSA or CSE), another member of the group evaluated the protocol.

A patient who had preoperative hypovolemia, preexisting neurological disease, coagulation disorders and/or was administered thromboprophylaxis less than eight hours before surgery; an infection at the puncture site; agitation or delirium; or a catheter in the urinary bladder was excluded.

In the case of accidental dural punctures during epidural injections, the catheter would be inserted into the subarachnoid space and such patients would be excluded from the study. If epidural space cannot be accessed within 15 minutes, single-shot spinal anesthesia will be administered, and such patients will be excluded.

The patients were premedicated with intravenous fentanyl 0.1mcg/kg and oxygen at a rate of 4 litres/minute upon entering the operating room. Monitoring included electrocardiography,

finger pulse oximetry, and noninvasive blood pressure measurement (every five minutes). Within 10 minutes, Ringer's lactate solution was administered intravenously in amounts of 100-200 ml.

During all blockades, the patient was awake in the lateral position.

For CSA,in L1-L2 space a 18G catheter over a 18-G TUOHY needle was used. The catheter was advanced until dural puncturing was felt and cerebrospinal fluid was observed inside the catheter after identifying the epidural space. Afterwards, the catheter was inserted into the intrathecal space over the needle. A luer connector and a filter previously filled with the anesthetic solution were attached to the catheter.

For CSE, Epidural blockade was performed in T12-L1 space with18G Tuohy needle and 18G catheter was inserted after identifying epidural space. Spinal blockade was performed in L1-L2 space with 23G quincke babcock needle.

Hyperbaric bupivacaine 15mg (3ml) was injected via catheter in the CSA group and via quincke babcock needle in the CSE group at a rate of 0.2ml/second while the patients were still in the lateral position.

Pinprick tests were used to determine the level of sensory blockade at one-minute intervals for the first five minutes, then at five-minute intervals until 15 minutes had passed. Additional bupivacaine was administered through the catheter if analgesia at level T4 was not achieved within 15 minutes: 5 mg (1 ml) in the CSA group or 25 mg (5 ml) via epidural catheter in the CSE group. A 15-minute revaluation of analgesia was conducted. Surgery could begin when the level was satisfactory. We recorded demographic data, catheter insertion time, perception of dural puncture by spinal needle, technique difficulty ("easy", "difficult" or "impossible"), the quality of sensory blockade, the quality of motor blockade, and the duration of the surgery.

After 30 minutes, the technique is considered unsuccessful if adequate surgical anesthesia is not achieved. When the patients complained of discomfort during surgery, they were given midazolam (1 mg intravenously) or fentanyl (25 mcg) to relieve their pain. All catheters were removed after the surgery and their patency was checked.

A 20 percent drop in systolic blood pressure was treated intravenously with ephedrine 6 mg, in comparison to preoperative control levels.0.5 mg of atropine was given intravenously for the treatment of bradycardia (defined as a heart rate less than 50 beats per minute). Patients were visited daily for the first five days after surgery. A phone interview regarding severe complications was conducted thirty days later.

Statistical analysis

The demographic data and other continuous variables were analyzed using Student's t-test. Mood’s test for medians, the $\chi 2$ test and Fisher’s exact test were used when appropriate. The significance level was set at P 0.05. There were no estimates of sample size for demonstrating particular differences, but the study power was 96% to detect the observed difference in paresthesia (in a one-sided setup), 90% to detect difficulty, and 91% to detect hypotension.

RESULTS

Regarding age, weight, height, and duration of surgery, the characteristics of the two groups of patients were comparable in terms of age, weight, height, and duration of surgery. It has been observed that almost all patients have had a successful dural puncture. Three patients in the CSA group and four patients in the CSE group had to be excluded as a result of an unintended dural perforation caused by the epidural needle during the epidural procedure.

There was no difference in the perception of dural puncturing ("click") between the two groups . It was also found that the time taken for performing the blockade was significantly shorter in the CSA group (2.6 ± 0.9 min) than in the CSE group (2.9 ± 1.2 min). In the CSE group, catheter introduction and subsequent extraction of the introducing needle were more challenging.

The catheters of all patients in the CSA group spontaneously filled with cerebrospinal fluid. Twelve patients had their catheters inserted one or two cm in the subarachnoid space, and 2 of them experienced paresthesia. In the CSE group, cerebrospinal fluid was obtained from 10 patients and an epidural catheter was inserted 4 to 5 cm into the epidural space. Only one of these patients exhibited paresthesia, so there was a significantly lower incidence of paresthesia in the CSE group (Table 3).

In patients receiving CSA the sensory level was adequate till T4 and in cases of CSE the sensory level was in the range of T4-T5.

On the Bromage scale, both groups had similar motor blockades. The first dose of 0.5% bupivacaine was sufficient to achieve sensory analgesia at T4 level in 14 patients in the CSA group and 12 in the CSE group. Supplemental doses were necessary in 2 CSA patients and 4 CSE patients.

Time, analgesia level, and blockade quality did not significantly affect the number of supplementary doses required (Table 4). Compared to the CSA group, 2 CSE patients had arterial hypotension, while no CSA patients had it (P = 0.002).

There were two patients with bradycardia in each group and one with postdural puncture headache (PDPH), with no significant differences between the groups. Both groups did not experience cauda equina syndrome, transient radicular symptoms, or severe complications 30 days postoperatively.

Table – 1. Dose of hyperbaric bupivacaine 0.5% and supplemental doses in abdominal oncological surgery

	Group I (CSA) n=25	**Group II (CSE) n=25**
150 cm -160 cm	5.0mg	5.0 mg
161 cm -170 cm	7.5mg	7.5 mg
> 170 cm	10.0mg	10.0 mg
Supplemental dose	2.5mg	25.0 mg

Table – 2. Abdominal oncological surgery patient characteristics

Variable	Group 1 (CSA)	Group (CSE)
N	25	25
Gender (male/female)	11/14	13/12
Weight (KG)[t]	78.1 ± 9.7	71.8 ± 11.8
Height (cm)t	162.8 ± 6.3	165.2 ± 7.5

Table – 3. Spinal anesthetic characteristics in abdominal oncological surgery patients

Characteristics	Group I (CSA)	Group II (CSE)	P
Duration of surgery (hours)	2.6 ± 0.5	2.6 ± 0.4	0.50
Performance time (minutes)	2.7 ± 0.33	2.8 ± 0.87	0.007
Dural puncture			
Easy / difficult	19/6	18/7	0.63
Perception of dural puncture	25	25	0.42
Catheter insertion			
Easy / difficult	22/3	19/6	0.005
Paresthesia	4/21	1/24	0.0002
Sensory level			0.006
T4	23	21	
T5	2	4	
T6	0	0	
Motor blockade			0.19
3	24	24	
2	1	1	
1	0	0	
0	0	0	

Table – 4. Doses of bupivacaine required for the abdominal oncological surgery

Characteristics	Group 1 (CSA)	Group (CSE)	P
Initial dose of hyperbaric bupivacaine 0.5%			
5 mg	8	7	
7.5 mg	6	6	0.175
10mg	6	5	
>10mg	5	7	
Supplemental dose	3/25	4/25	0.18
Level / quality	3	1	
2.5 mg	0	0	

5 mg	0	0	
7.5 mg	0	0	
10mg	1	0	
>10mg	3		
Time	4	4	0.88
2.5 mg	2	0	
5 mg	1	0	
7.5 mg	0	0	
10mg	0	0	
>10mg	1	7	
Total anesthetic dose (mg)	6.85±2.17	16.7±11.8	<0.00005

Discussion

The results from this study indicate that CSA and CSE are both effective and safe techniques. CSA provided better cardiovascular stability with a smaller dose of local anaesthetic and shorter onset time, and without failures. We used epidural needle for CSA as it is cost effective and the technique is easy[7]. However, CSA has not gained wide popularity because of the fear of post anaesthetic cauda equina syndrome, and the difficulty in placing micro catheters into the subarachnoid space. As there are technical difficulties in introduction of spinal catheters and inaccessibility to such catheters in peripheral South India we resorted to this study of introduction of epidural needle. We did not encounter any failure and the catheter was inserted in the first attempt in all cases (100%) [8].

No prospective trials examining optimal medication administration for CSA have been reported on abdominal oncological surgery. However, our study provides information adequate for recommendations on the dosing of CSA for abdominal oncological surgery and we present such as per our local institutional protocols.

In a recent study, it was found that CSA took longer. . The use of different types of needles may explain different onset times. In the CSE group, the onset time was 2.9 ± 1.2 min, the same as was published in a previous study[9].

According to previous reports, comparing CSA with CSE among trauma patients, Wilhelm and Standl obtained better results with significantly smaller doses of local anesthetic and lower risk of hypotension when using CSA, while technical problems were more frequent with CSE. Those authors concluded that CSE did not have any advantage over CSA for emergency patients. In our study, we found the same degree of difficulties in both groups [10].

Conclusion

Our results suggest that both CSA and CSE provided good surgical conditions with low incidence of complications. CSA provided better cardiovascular stability with a smaller dose of local anaesthetic and shorter onset time, and without failures. We used epidural needle for CSA as it is cost effective and the technique is easy.

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