Original Research
Medical Journal of Islamic Republic of Iran, Vol. 26, No. 2, May. 2012, pp. 85-89

Intrathecal fentanyl for prevention of shivering in spinal anesthesia in cesarean section

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Received: 22 May 2011 Revised: 12 November 2011 Accepted: 18 January 2012

Abstract

Background: Shivering is one of the common problems in spinal anesthesia. The objective of the present study was to evaluate the effect of intrathecal fentanyl (25 μg) on incidence and severity of intraoperative and postoperative shivering.

Methods: A double-blind randomized controlled study was conducted in **e**ighty healthy women (ASA Physical status I) scheduled for elective cesarean section under spinal anesthesia. Subjects were randomly divided into two equal groups. The patients received 12.5 mg (2.5ml) of 0.5% hyperbaric bupivacaine combined with 25 μg (0.5 ml) fentanyl in Group F as a study group and 12.5 mg (2.5ml) of 0.5 % hyperbaric bupivacaine combined with 0.5 ml normal saline in Group S as a control group. Incidence of shivering during 30 and 60 minutes of surgery and recovery and complications were evaluated.

Results: The total incidence of shivering in Group F was significantly lower than Group S (10% in group F; 75% in group S, $p< 0.0001$). Almost all patients started shivering in the first hour after spinal anesthesia and the rate of shivering especially in second 30 minutes was higher than first 30 minutes in both groups. None in Group F but 22 patients (55%) in Group S had shivering during recovery and all of them reported shivering at the first 30 minute at recovery. The severity of shivering in Group F was significantly lower than Group S ($p <0.0001$).

Conclusion: Intrathecal bupivacaine combined with fentanyl is associated with a lower incidence and severity of shivering.

Keywords: Shivering; Fentanyl; Spinal anesthesia; Cesarean section.

Introduction

Spinal Anesthesia is often used for elective or emergency cesarean section. Shivering is one of the common problems in spinal anesthesia and its incidence was reported up to 56.7% (1-3). Shivering is uncomfortable for the patient and may interfere with monitoring of electrocardiogram, blood pressure (BP), and oxygen saturation. It increases oxygen consumption, lactic acidosis and carbon dioxide productionn (4-6). Although intravenous meperidine and tramadol are widely used to treat shivering after spinal anesthesia, it may have adverse effects on the baby if they were injected before delivery of the baby (6,7).

Fentanyl is well known for its rapid onset and shorter duration of action following intrathecal administration (8,9). A small dosage of fentanyl (10-40 μg) administered directly into the cerebrospinal fluid has been

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found to be very effective in minimizing discomfort during and after cesarean section without increasing serious adverse effects (9-13). Chow et al have suggested that intrathecal fentanyl could decrease both the incidence and severity of shivering during spinal anesthesia for transurethral resection of prostate (14). Chu et al reported that intrathecal fentanyl 12.5 and 15 μg added to bupivacaine decreased the incidence of shivering in caesarean section (15). Other studies by Techanivate et al showed the incidence of shivering after appendectomy and cesarean section was significantly lower in fantanyl group in compared with saline normal which was added to bupivacaine or mixture of bupivacaine and morphine (16, 17).

The first objective of our study was to evaluate the effect of intratechal fentanyl (25 μg) on incidence of intraoperative and postoperative shivering. Meanwhile the severity of shivering and side effects of fentanyl (nausea, vomiting, itching and hypotension) were investigated.

Methods

The protocol was approved by the medical ethics committee of Arash university hospital. Informed consent was obtained from 80 healthy women based on American Society of Anesthesiologists classification system (ASA Physical status I) scheduled for elective term cesarean section under spinal anesthesia. Parturients with contraindication to spinal anesthesia, allergy to the local anesthetics or fentanyl, metoclopramide, ephedrine and pethidine were excluded.

Subjects were randomly divided into two equal groups by sequentially numbered, sealed opaque envelopes (40 patients in each group). In order to facilitate blinding, test solutions were prepared by an anesthetic nurse who was not involved in the study.

Neither the anesthesiologist nor the parturient herself was aware of the drugs and a blinded investigator evaluate for presence and severity of shivering. The ambient temperature of operating room was maintained at 24 °C. A wide-bore intravenous catheter (no: 18) into a forearm vein was inserted and ringer lactate 10ml/kg was administered. Monitoring included oral temperature, pulse oximetry, non-invasive arterial pressure and ECG. Spinal anesthesia was performed at L3-4 with 25G Quincke needle in the sitting position. The patients received 12.5 mg (2.5ml) of 0.5% hyperbaric bupivacaine combined with 25 μg (0.5 ml) fentanyl in Group F as a study group and 12.5 mg (2.5ml) of 0.5 % hyperbaric bupivacaine combined with 0.5 ml normal saline in Group S as a control group, respectively. All fluids were stayed at room temperature for 24 hours before used. On completion of spinal injection the patient was placed in the supine position with left uterine displacement.

Measurements: Sensory analgesia was evaluated by pinprick before the start of surgery and rechecked for at least 15 min after spinal anesthesia. Continues pulse oximetry and arterial blood pressure was recorded every minute until delivery and then every 5 minute until the end of surgery. Oral temperature was rechecked 30 minute after the beginning of surgery. Pain was checked objectively at the time of patient complain by Visual Analogue Scale (VAS, 0= no pain and 10= the worst imaginable pain). Shivering by a 4-point rating score (0= None, 1= Mild fasciculation in face or neck, 2= Visible tremor in more than one muscle group, 3 =Shivering involving whole body) was checked every 5 minutes during surgery and at recovery for two hours. Episodes of perioperative side effects such as hypotension (SBP<30% from baseline or<80 mmHg) bradycardia (HR< 60 bpm), oxygen desaturation (SPO_2 <90%), respiratory depression (RR <12 bpm) and hypothermia (temperature< 35 °C) and itching were recorded. Hypotension was treated with bolus of fluid and incremented dose of ephedrine 10 mg IV and bradycardia was treated with atropine 0.5 mg IV. Pain with VAS≥ 4 was treated with incremented dose of fentanyl 25 μg IV and shivering with score≥ 2 was treated with pethidine 30 mg IV. Intravenous metoclopramide 10 mg was used to treat nausea and

Table 1. Patients characteristics.

	Group F	Group S	
	N=40	N=40	p value
Age (yr)	27.2 ± 5.31	27.13 ± 4.98	0.95
Weight (kg)	78.58 ± 11.75	77.95 ± 12.99	0.82
Height (cm)	162.75 ± 5.03	162.75 ± 4.60	1
BMI (kg/m^2)	29.54 ± 3.14	29.34 ± 4.01	0.8
Onset time of analgesia (sec)	45.50 ± 13.77	49 ± 14.11	0.26
Duration of surgery (min)	48.50 ± 13.01	49.88 ± 12.73	0.63
Oral Temperature (°C)	37.07 ± 0.16	37.07 ±0.14	0.9
Maximal block height			
T4	11 (27.50)	6 (15)	
T5	26 (65)	30 (75)	
T6	3 (7.5)	4 (10)	0.39

Group F; Fentanyl,
Group S; Saline normal
(Data are expressed as mean ± SD or number (percentage)).
P-value refer to t-test and Chi square –test.

vomiting.

Statistical Analysis: The primary outcome measure in this study was incidence of shivering. By using Epi Info site (www.cdc.gov/epiinfo/), 30 patients in each group would be required to detect 40% reduction in the intraoperative and postoperative shivering with power of 90% and α= 0.05. Statistical analysis was performed with JMP software (Version 4; SAS institute, USA). Statistical significance for differences was tested by student's t-test and χ^2-test when appropriate. A *p*-value less than 0.05 were considered statistically significant.

Results

The flowchart shows the recruitment of patients in this study. There was no difference between groups with regard to demographic data, duration of surgery, and onset time of analgesic, oral temperature and highest sensory level (Table 1).

The data of the total incidence and severity of shivering after spinal anesthesia were presented in Table 3. The total incidence of shivering in Group F was significantly lower than Group S (4 of 40 patients, 10% in group F; 30 of 40 patient, 75% in group S, p< 0.0001). Almost all shivering patients started shivering in the first hour after spinal anesthesia and the rate of shivering especially in second 30 minutes was higher than first 30 minutes in F group. However the rate of shivering in S group was higher in first 30 minutes after surgery.

Table 2. Incidence and severity of shivering.

	Group F	Group S	
	N=40	N=40	p value
Incidence, n (%)			
The Total Incidence	4 (10)	30 (75)	<0.0001
During Surgery	4 (10)	16 (40)	0.002
First 30 minutes	1 (2.5)	10 (25)	
Second 30 minutes	3 (7.5)	8(20)	
During recovery	0 (0)	22 (55)	<0.0001
First 30 minutes	0 (0)	22(55)	
Second 30 minutes	0	0	
Severity (1+,2+,3+)			
Total severity	1,3,0	19,12,9	<0.0001
During Surgery	1,3,0	8,5,4	
During Recovery	0,0,0	11,7,5	

*Data are presented as number and percent in parenthesis.

None in Group F but 22 patients (55%) in Group S had shivering during recovery and all of them reported shivering at the first 30 minute at recovery.

The severity of shivering in Group F was significantly lower than Group S (p <0.0001). In Group F one patient with mild and three patients with moderate shivering were reported. None in group F had severe shivering during surgery or recovery (Table 2).

Meanwhile, table 3 shows that nausea (p = 0.05) and vomiting (p= 0.03) in Group F was lower than second group. None of patients in two groups have itching or respiratory depression. Fourteen patients in Group S and one patient in group F was treated by fentanyl because of pain.

Table 3. Evaluation of Side effects in two groups.

	Group F	Group S	
	N=40	N=40	p value
Nausea	7 (17.95)	15 (37.50)	0.05
Vomiting	4 (10)	12 (30)	0.03
Hypotension	30 (75)	31 (77.5)	0.79

*Data are presented as number and percent in parenthesis.

Discussion

Our study results manifested that the addition of 25 µg fentanyl to hyperbaric bupivacaine for spinal anesthesia in patients undergoing cesarean section, reduces the incidence and severity of intraoperative and postoperative shivering. Chow et al study showed the administration of a small dose (1.25 µg) of intrathecal fentanyl had significant influence on the incidence and severity of shivering during transurethral resection of prostate under spinal anesthesia (14).

But another study by Chu et al revealed the combination of bupivacaine with a dose of fentanyl as low as 7.5 µg did not produce actual clinical effects and as the dose of fentanyl was increased to 12.5 µg or 15 µg the quality of surgical analgesia was better and the incidence of shivering was decreased significantly (15).

Techanivate et al study showed the 20 µg fentanyl added to hyperbaric bupivacaine can reduce the incidence and severity of shivering without increasing other side effects such as hypotension, nausea and vomiting and these side effects had not significant differences with saline normal group (17).

However, our study showed that the vomiting was significantly higher in saline normal group (p value = 0.03). Nausea is lower in fentanyl group but not statistically significant (p value = 0.05). These better results in lower incidence of nausea and vomiting in our study may be due to increasing the dose of fentanyl (25 µg) and increasing the quality of analgesia, in compared with Techanivate investigation (20 µg).

Itching is another frequent complication of intrathecal administration. Hunt et al observed a significant increase in the overall incidence of itching in the 25 µg and 50 µg fentanyl group (18). Other studies by 10, 40 and 50 µg fentanyl reported itching and none in 5 and 20 µg (9,13). But in our study none of the patients in each group experienced itching.

It seems that usage of 25 µg intrathecal fentanyl in our study had benefits without additional side effects and it was not necessary to use higher doses because intraoperative respiratory depression and increased sedation were observed in those groups who received 40 µg or more (11).

The mechanism of shivering under spinal anesthesia is not fully understood. In this study we tried to control some possible contributing factors such as cold operating room which was maintained at 24 °C and avoidance of rapid infusion of cold crystalloid solutions.

Fentanyl is a highly ionized, lipophilic µ-receptor agonist. When it is administered intratecally, the unionized component is rapidly transferred into the spinal cord. The reduction of shivering in the present study maybe attributable to the effect of fentanyl that was added into the subarachnoid space on the thermo-regulator and spinal affect afferent thermal inputs at the spinal cord (17).

In conclusion, we believe that intrathecal

bupivacaine combined with fentanyl 25 μg is associated with a lower incidence and severity of shivering than a combination of bupivacaine and saline normal.

References

1. Chan AM, Ng KF, Tong EW, Jan GS (1999). Control of shivering under regional anesthesia in obstetric patients with tramadol. Can J Anaesth 46(3):253-8.
2. Sessler DI, Ponte J (1990). Shivering during epidural anesthesia. Anesthesiology 72(5):816-21.
3. Jeon YT, Jeon YS, Kim YC, Bahk JH, Do SH, Lim YJ (2005). Intrathecal clonidine does not reduce post-spinal shivering. Acta Anaesthesiol Scand 49(10):1509-13.
4. Macintyre PE, Pavlin EG, Dwersteg JF (1987). Effect of meperidine on oxygen consumption, carbon dioxide production, and respiratory gas exchange in postanesthesia shivering. Anesth Analg 66(8):751-5.
5. Piper SN, Fent MT, Röhm KD, Maleck WH, Suttner SW, Boldt J (2001). Urapidil does not prevent postanesthetic shivering: a dose-ranging study. Can J Anaesth 48(8):742-7.
6. Tsai YC, Chu KS (2001). A comparison of tramadol, amitriptyline, and meperidine for postepidural anesthetic shivering in parturients. Anesth Analg 93(5):1288-92.
7. Kranke P, Eberhart LH, Roewer N, Tramer MR (2002). Pharmacological treatment of postoperative shivering: a quantitative systematic review of randomized controlled trials. Anesth Analg 94(2):453-60.
8. Leighton BL, DeSimone CA, Norris MC, Ben_David B (1989). Intrathecal narcotics for labor revisited: the combination of fentanyl and morphine intrathecally provides rapid onset and profound, prolonged analgesia. Anesth Analg 69(1):122-5.
9. Rueben SS, Dunn SM, Dupart KM, O'Sullivan P (1994). An intrathecal fentanyl dose-response study in lower extremity revascularization procedures. Anesthesiology 81(6):1371-5.
10. Obara M, Sawamura S, Satoh Y (2003). The effect of intrathecal fentanyle added to hyperbaric bupivacaine for cesarean section. Masui 52(4):378-82.
11. Belzarena SD (1992). Clinical effects of intrathecally administered fentanyl in patients undergoing cesarean section. Anesth Analg 74(5):653-7.
12. Hunt CO, Naulty JS, Bader AM (1989). Perioperative analgesia with subarachnoid fentanyle-bupivacaine for cesarean delivery. Anesthesiology 71(4):535-40.
13. Dahlgern G, Hultstrand C, Jakobsson J (1997). Intrathecal sufentanyl, fentanyl, or placebo added to bupivacaine for cesarean section. Anesth Analg 85(6):1288-93.
14. Chow TC, Cho PH (1994). The influence of small dose intrathecal fentanyl on shivering during transurethral resection of prostate under spinal anesthesia. Acta Anaesth Singapore 32(3):165-70.
15. Chu CC, Shu SS, Lin SM, Chu NW (1995). The effect of intrathecal bupivacaine with combined fentanyl in caesarean section. Acta Anaesth Singapore 33(3):149-54.
16. Techanivate A, Urusopone P, Kiatgungwangliam P, Kosawiboonpol R (2004). Intratechal fentanyl in spinal anesthesia for appendectomy. J Med Assoc Thai 87(5):525-30.
17. Techanivate A, Rodanant O, Tachawattanwisel W, Somsiri T (2005). Intratechal fentanyl for prevention of shivering in cesarean section. J Med Assoc Thai 88(9):1214-21.
18. Hunt CO, Naulty JS, Bader AM, Hauch MA, Vartikar JV, Datta S, Hertwig LM, Ostheimer GW (1989). Perioperative analgesia with subarahnoid fentanyl-bupivacaine for cesarean delivery. Anesthesiology 71(4):274-8.