Painless childbirth? Epidural and spinal techniques in obstetric anesthesia

Schyns-van den Berg, A.M.J.V.

Chapter 6

Effect of height versus height/ weight-based spinal bupivacaine on maternal hemodynamics for elective cesarean in short stature patients: a randomized clinical trial

Asish Subedi,
Parineeta Thapa,
Rajesh Prajapati,
Alexandra M. J. V. Schyns-van den Berg

Published: Journal of Anesthesia 2023 Dec; 37(6): 905-913

ABSTRACT

Purpose

Doses of spinal bupivacaine adjusted to patient height or height/weight have been shown to provide hemodynamic stability during cesarean section. However, their effects in short stature parturients are unknown.

Methods

In this double-blind, randomized clinical trial, we randomly assigned short parturients (height < 150 cm) undergoing elective cesarean section, to receive doses of intrathecal hyperbaric bupivacaine either height or height/weight-adjusted, in a 1:1 ratio. The primary outcome was post-spinal hypotension (defined as systolic blood pressure [SBP] <90% of baseline between spinal administration and delivery of the baby). Secondary outcomes included severe post-spinal hypotension (SBP < 80% of baseline), post-delivery hypotension (SBP < 90% and < 80% of baseline), intraoperative bradycardia, nausea and vomiting, shivering, rescue analgesic needed, and spinal block characteristics.

Results

A total of 112 patients underwent randomization. Post-spinal hypotension (SBP < 90% of baseline) occurred in 52% of the patients in the height/weight group and in 55% in the height group (difference − 3.5%: 95% confidence interval [CI] − 22 to 14.8, $P = 0.705$). There was no significant difference between the two groups in the occurrences of post-spinal severe hypotension (SBP < 80% of baseline), post-delivery hypotension, and spinal block characteristics. Six patients (11%) in the height/weight group needed intraoperative rescue analgesic compared to none in the height group ($P = 0.027$).

Conclusion

We found that height-based dosing in short parturients provides the optimal trade-off between intraoperative hemodynamic instability and provision of pain-free anesthesia.

INTRODUCTION

The most common side effect of spinal anesthesia in women undergoing cesarean section is hypotension, which occurs in more than two-thirds of patients if no prophylactic measures are taken [1]. If this hypotension is not prevented nor treated immediately, it may cause maternal nausea, vomiting, dizziness, and reduced consciousness; it can also impair uteroplacental perfusion, which may result in fetal bradycardia, depressed Apgar scores and fetal acidosis [2]. To prevent or treat hypotension, several strategies have been extensively studied, such as reducing the dose of intrathecal local anesthetic (LA), co-loading with intravenous fluids, vasopressors, and appropriate positioning of the mother [3, 4].

The dose of intrathecal local anesthetic is the main factor determining the balance between a successful block and the occurrence of maternal hypotension. The ED95 of intrathecal bupivacaine to achieve successful anesthesia, when co-administered with intrathecal opioids, ranges from 11 to 12.6 mg [5, 6]. As maternal hypotension and nausea/vomiting still occur at these recommended doses, several investigators have explored the effectiveness of lower doses of bupivacaine. Lowering the dose of intrathecal bupivacaine provides better maternal hemodynamic stability, but it may compromise the quality of anesthesia. Moreover, there is no consensus regarding the cut-off at which the dose is defined as low [6].

Studies have demonstrated that tailoring doses of LA for spinal anesthesia to maternal weight and height or height-based regimens can decrease the risk of hypotension while producing similar anesthesia quality compared to fixed conventional doses [7-9]. Adjusting the doses of LA based on body habitus could limit the maximum cephalad spread using smaller doses in the tailored regimen, which is less than the fixed regimen. Further, the intrathecal bupivacaine doses based on height and weight tends to be lower than doses based on height alone [7, 8]; as a result, hypotensive events are more likely to occur in height-based regimen. In a comparison between height-based dosing and height/weight-based dosing, the height-based dosing group had a significantly higher occurrence of hypotension, even though there were no significant differences in the dosages of bupivacaine [10]. The lower mean height of patients in the height-based dosing group in comparison to the height/weight-based dosing group may have contributed to the higher incidence of hypotension seen in the former group [10]. Nonetheless, these studies were conducted in parturients with normal ranges of height, and the effectiveness of these dosing schemes in short-statured parturients remains unexplored.

Therefore, the present randomized trial was designed to compare the hemodynamic effects and effective anesthesia of two dosing regimen of intrathecal bupivacaine for CS in short stature patients based on height versus height/weight. Our hypothesis was that administering spinal bupivacaine doses based on both height and weight, as determined by Harten et al. [8], would result in a lower incidence of hypotension in short stature patients, compared to those who receive doses based on height alone.

METHODS

This randomized double-blind clinical trial was conducted at BP Koirala Institute of Health Sciences (BPKIHS) from November 2019 to September 2021. This study was approved by the BPKIHS Institutional Review Committee (IRC no. IRC/11525/019) and the Nepal Health Research Council Ethical Review Board (ERB protocol no. 630/2019). The written informed consent was obtained from all subjects participating in the trial. The trial was registered prior to patient enrollment at clinicaltrials.gov (NCT04082676, Principal investigator: Asish Subedi, https://clinicaltrials.gov/ct2/show/NCT04082676, Date of registration: September 9, 2019). The trial was conducted in accordance with the principles of the 1964 Declaration of Helsinki and adheres to the applicable CONSORT guidelines. Patients were screened for eligibility by the investigators the night before surgery, during the pre-anesthetic visit at the in-patient unit. During this visit, patients were educated regarding the use of numeric rating scale (NRS) scores and written informed consent was obtained. Preoperative anxiety was recorded in NRS scores, with 0 = no anxiety and 10 = maximum anxiety, as reported by the patient.

Eligible subjects were full-term singleton parturients with height < 150 cm of American Society of Anesthesiologists physical status II, scheduled for elective cesarean section under spinal anesthesia. Patients with height < 140 cm, hypertensive disorders, placental disorders, body mass index ≥ 40 kg/m^2, endocrine or hormonal disorders, cardiovascular, cerebrovascular, or renal diseases, polyhydramnios or a known history of obstetric morbidity or fetal abnormalities and baseline systolic blood pressure (SBP) less than 100 mmHg were excluded from the study. The enrolled patients were randomly assigned to 2 equal groups (allocation ratio 1:1) according to an online generated randomization list (https://www.sealedenvelope.com), using the variable block sizes of 4, 6 and 8. An independent researcher created the trial-group assignment and concealed the group allocation in sequentially numbered, sealed opaque envelopes. On the day of surgery, each secured envelope was handed over to the anesthesia assistant who prepared the drug mixture for spinal anesthesia according to the group allocation. In one group, the dose of hyperbaric bupivacaine 0.5% was calculated from the chart provided by Harten and colleagues (Table 1) based on height/weight [8]; while in the other group, the dose was based on patients' height (0.06 mg/cm) [7]. Fentanyl (10 µg) was added to the bupivacaine in both groups.

Patients fasted for at least 8 h and received ranitidine 50 mg and metoclopramide 10 mg intravenously via an 18-gauge cannula before transfer to the operation room. The patient was positioned on the operating table with a 15° wedge under the right buttock and standard monitoring (electrocardiography, pulse oximetry, and noninvasive blood pressure) was applied. Three successive readings of heart rate (HR) and systolic blood pressure (SBP) were taken at 2-min intervals. The averages of these recordings were documented as baseline parameters.

The subarachnoid block was performed by the attending anesthesiologist in the sitting position at the L3-L4 or L4-L5 vertebral interspace using a 25-gauge Quincke spinal needle via the midline approach. The study solution was administered according to the group allocated. The patient was immediately repositioned supine, with the 15° wedge in place. Immediately after spinal injection, patients received 1L of Ringer's lactate as co-loading over 10-15 min, using a pressurizer bag. Patients, attending anesthesiologists, and the investigator who collected the data and assessed the outcomes were blinded to the study group allocation.

Table 1 Height/weight-based dosing regimen of 0.5% hyperbaric bupivacaine for spinal anesthesia for cesarean section [8]

Patient weight (kg)	Patient height (cm)								
	140	145	150	155	160	165	170	175	180
50	1.5	1.7	1.8	1.9					
55	1.5	1.6	1.8	1.9	2				
60	1.4	1.6	1.7	1.8	2	2.1			
65	1.4	1.5	1.7	1.8	1.9	2.1	2.2		
70	1.3	1.5	1.6	1.8	1.9	2	2.2	2.3	
75		1.4	1.6	1.7	1.9	2	2.1	2.3	2.4
80		1.4	1.5	1.7	1.8	2	2.1	2.2	2.4
85			1.5	1.6	1.8	1.9	2.1	2.2	2.3
90			1.4	1.6	1.7	1.9	2	2.2	2.3
95				1.5	1.7	1.8	2	2.1	2.3
100				1.5	1.7	1.8	1.9	2.1	2.2
105					1.6	1.7	1.9	2	2.2
110						1.7	1.8	2	2.2

Values are in milliliters

Immediately after spinal injection, sensory levels were assessed bilaterally at the anterior axillary line with a cotton swab soaked with ethyl chloride. The block level was checked every min for the first 10 min, and the maximum level attained was registered. Surgery was allowed to commence once the sensory loss reached a level of T6 or higher, bilaterally. If the sensory block level did not reach T6 within 10 min, patients were placed in 15° Trendelenburg position. If the sensory block height was still below T6, the procedure was considered a failed spinal and the patient received general anesthesia. Motor block was assessed every min, for 10 min after injection, using the Bromage motor blockade scale scores [11].

SBP was recorded every minute for the first 10 min, every 2.5 min for the next 10 min, and then every 5 min till the end of surgery. Post-spinal hypotension (time from spinal injection

to delivery) was defined as a SBP < 90% of baseline and severe post-spinal hypotension was defined as a SBP < 80% of baseline. Post-delivery hypotension (time from delivery of the baby to end of surgery) was defined as a SBP < 90% of baseline and severe post-delivery hypotension was defined as a SBP < 80% of baseline. SBP's < 90% and < 80% of baseline were treated with bolus injections of phenylephrine 50 µg and 100 µg, respectively. Also, Ringers lactate was administered rapidly when hypotension occurred. Hypotension associated with bradycardia (HR < 50 beats/min) was treated with IV ephedrine 6 mg followed by IV atropine 0.5 mg.

Intravenous fentanyl 20 µg was administered if a patient reported intraoperative pain, and this dose was repeated when necessary. In case of persisting pain, IV ketamine 0.25 mg/kg was given. All patients received IV ondansetron 4 mg. Patients were instructed to report intraoperative nausea based on an 11-point NRS, where 0 describes "no nausea" and 10 describes nausea "as worst as it could be". NRS > 0 was considered as nausea; patients reporting the NRS score ≥ 5 for nausea and/or vomiting were managed with IV dexamethasone 4 mg. Occurrence of intraoperative pruritus, shivering (based on grading described previously) [12], and dizziness was recorded. All patients were covered with one layer of surgical drapes over the chest, thighs, and calves during the operation and one cotton blanket over the entire body after the operation. The operating room temperature was maintained at 23-25 °C. IV fluids were administered at room temperature. The volume of intraoperative IV fluids used and the estimated blood loss were recorded for each patient. Supplemental oxygen was administered at a rate of 5 L/min through a face mask during the operation. Intraoperative pruritus was assessed using the NRS scale (0-10 scale, with 0 = no pruritus, and 10 = worst pruritus imaginable), with a NRS score ≥ 4 was treated with IV chlorpheniramine 10 mg.

Oxytocin 2 U was administered IV over 5-10 s after delivery of the baby, followed by a maintenance infusion of 10 u/h (oxytocin 20 u in 500 ml of Hartmann's solution). Quality of anesthesia was assessed using a four-point scale: 1 =excellent; 2 = good: some feelings but no discomfort; 3 =fair: some discomfort but rescue analgesia unnecessary; and 4 = poor: major discomfort which required rescue analgesia. Surgeons were asked to grade operating conditions as "very good", "good" or "poor." Neonatal Apgar scores were recorded at 1 and 5 min after delivery by the attending pediatrician. Bupivacaine 0.25% (30 ml) was infiltrated subcutaneously after closure of the skin incision. At the end of surgery, sensory and motor block levels were assessed using the absence of touch and the Bromage scale at 10-min intervals, until the sensory block level had regressed to T10 and the motor block had recovered to a Bromage scale score of 0. Patient satisfaction with intraoperative anesthesia for cesarean section was recorded before discharge from PACU, using NRS scores with 0 = "very dissatisfied" and 10 ="very satisfied". Duration of the pain-free period was defined as the time (h) between the intrathecal injection and the first perception of pain. Postoperative analgesia was administered at the discretion of the attending obstetrician.

The primary outcome was the incidence of post-spinal hypotension. Secondary outcomes were frequencies of severe post-spinal hypotension, post-delivery hypotension, severe post-delivery hypotension, bradycardia, nausea, vomiting, pruritus, shivering, dizziness, need for supplemental intraoperative analgesic, post-spinal sensory and motor block characteristics, quality of anesthesia, patient satisfaction with anesthesia, and neonatal Apgar scores at 1 and 5 min after delivery.

Sample size calculation

A previous study reported the incidence of hypotension as 57% and 27% in parturients receiving IT bupivacaine based on height-based versus height/weight-based regimens, respectively [10]. To detect a difference of 30% in the incidence of post-spinal hypotension, we needed 48 subjects in each group with a power of 80% and using a two-tailed alpha of 0.05 (STATA version 15.1, STATA Corp., TX). Assuming a 15% attrition rate, we enrolled 112 patients (56 in each group).

Statistical analysis

Normality of the continuous data was assessed using histograms and the Shapiro-Wilk test. The mean (standard deviation) was used for normally distributed variables and the median (interquartile range) for data that were not normally distributed. For categorical variables, number (percentage) was used. The Student's unpaired t tests and the Mann-Whitney U tests were applied for continuous data which showed normal and skewed distribution, respectively. For categorical variables, the Chi-square test was used, and otherwise the Fisher exact test was used if the expected values in any of the cells of a contingency table were less than 5. For comparison of the incidence of hypotension, we used between-group differences in percentage points with a corresponding 95% confidence interval. A two-sided *P*-value < 0.05 was considered as statistically significant. Statistical analysis was performed using STATA version 15.1 (STATA Corp., TX).

Fig. 1 Screening, randomization, and analysis

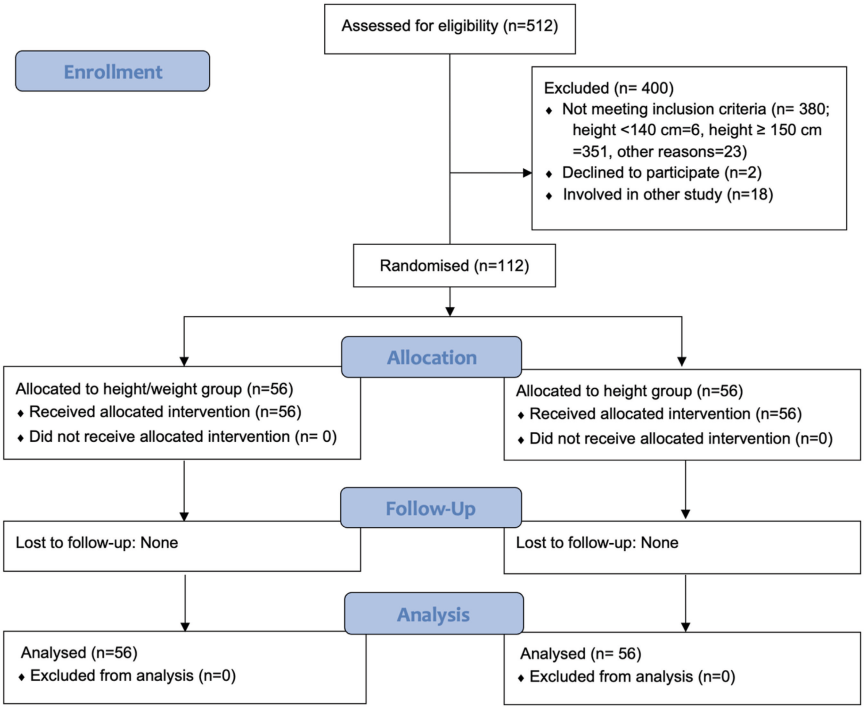


Table 2 Patient demographic and baseline characteristics

Variables	Height/weight-based group (n = 56)	Height-based group (n = 56)	*P*-value
Age (years)	27.2 ± 5.2	26.3 ± 4.6	0.334
Height (cm)	146.3 ± 2.1	145.7 ± 2.3	0.176
Weight (kg)	58.6 ± 7.0	59.4 ± 8.6	0.625
BMI (kg/m^2)	27.4 ± 3.5	27.9 ± 4.0	0.457
Period of gestation (weeks)	39.1 ± 1.3	39.3 ± 1.2	0.432
Anxiety, NRS score*	2 (1-3)	2 (1-4)	0.207
Systolic blood pressure (mmHg)	118.5 ± 9.5	121.4 ± 11.1	0.133
Heart rate (beats/min)	90.4 ± 11.6	89.0 ± 12.4	0.562

Values are in mean ± SD, median (interquartile range)
Abbreviations: NRS, numeric rating scale; BMI, body mass index
**Using a 0-10 cm scale, with zero meaning "no anxiety" and 10 meaning "maximum anxiety"*

RESULTS

A total of 512 patients were assessed for eligibility, of whom 112 were enrolled and randomized into two groups to receive either an adjusted dose of IT bupivacaine based on patient height/weight combined (56 patients) or based on patient height only (56 patients). All patients completed the study (Fig. 1). The baseline characteristics of the patients are presented in Table 2. The mean dose of spinal bupivacaine was 8.33 (0.59) mg in the height/weight-based group and 8.73 (0.28) mg in the height-based group (mean difference − 0.40, *P* < 0.001) (Table 3).

Table 3. Surgical profiles and spinal block characteristics

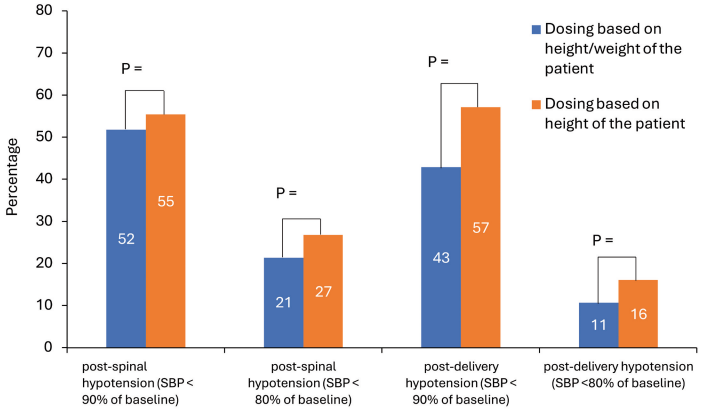
Variables	Height/weight-based group (n = 56)	Height-based group (n = 56)	*P*-value
Spinal bupivacaine dose (mg)	8.33 ± 0.59	8.73 ± 0.28	< 0.001
Induction to skin incision (min)	6.0 ± 2.4	6.6 ± 2.1	0.20
Induction to delivery time (min)	13.8 ± 4.1	14.6 ± 4.3	0.319
Uterine incision to delivery time (s)	60 (30–120)	60 (27.5–120)	0.61
Maximum spread of block height (thoracic dermatome, T)	4 (4–4)	4 (4–4)	0.223
Time to reach block height T6 (min)	3 (3–4)	3 (2–4)	0.399
Motor onset (min)	4 (3–5.5)	4 (3–6)	0.259
Head down tilt needed	3 (5.36)	2 (3.57)	1
2-Segment regression (min)	60 (45–70)	60 (50–70)	0.792
Sensory regression to T10	100 (80–120)	110 (90–125)	0.182
Duration of motor block (min)	130 (120–150)	150 (130–170)	0.059
Total duration of surgery (min)	50 (42.5–60)	45 (40–55)	0.141
Fluid received (ml)	1400 (1300–1500)	1400 (1300–1500)	0.858
Blood loss (ml)	425 (400–550)	500 (400–525)	0.682
Oxytocin needed (Units)	10.9 ± 2.7	11.1 ± 3.3	0.723
Other uterotonic agents used	1 (1.79)	2 (3.57)	1

Values are in mean ± SD, median (interquartile range) and number (percentage)

Post-spinal hypotension (SBP < 90% of baseline) occurred in 29 of the 56 patients (52%) assigned to the height/weight-based group, as compared to 31 of the 56 patients assigned to the height-based group (55%) (absolute difference − 3.5%; 95% confidence interval [CI] − 22 to 14.8; *P* = 0.705). Post-spinal severe hypotension (SBP < 80% of baseline) was observed in 12 of 56 patients (21%) in height/weight-based group and in 15 of 56 patients (27%) in height-based group (absolute difference − 5.3%; 95% CI − 21.1 to 10.4; *P* = 0.508). Post-delivery

hypotension (SBP <90% of baseline) occurred in 24 of the 56 patients (43%) assigned to the height/weight-based group, as compared with 32 of the 56 patients assigned to the height-based group (57%) (absolute difference − 14.2%; 95% CI − 32.6 to 4; *P* = 0.131). Six of 56 patients (11%) in the height/weight-based group and 9 of 56 patients (16%) in the height-based group experienced post-delivery severe hypotension (SBP <80% of baseline), for an absolute difference of − 5.3% (95% CI −17.9 to 7.2; *P* = 0.405) (Fig. 2).

Fig. 2 The percentage of patients who developed hypotension in each trial group.



Height/weight group: no./ total no.	29/ 56	12/56	24/56	6/56
Height group: no./ total no.	31/56	15/56	32/56	9/56

Abbreviation: SBP, systolic blood pressure

Differences in the spinal block characteristics between the two groups are shown in Table 3. More participants in the height/weight-based group than in the height-based group required fentanyl supplementation for intraoperative pain (6 [11%] vs. 0 [0%] participants, *P* = 0.027). Intraoperative nausea occurred in 3 of the 56 patients (5.36%) in the height/weight-based group and in 2 of the 56 patients (3.37%) in the height-based group. Two patients (3.57%) in height/weight-based group and three (5.36%) patients in height-based group developed intraoperative shivering. No patient in either treatment group reported bradycardia (HR < 50/min), vomiting, pruritus or dizziness. None of the patients required rescue ketamine or rescue anti-emetics during the trial. Neonatal Apgar scores at 1 min and 5 min after delivery did not differ significantly between the trial groups. There was no significant between-group difference in the operative quality or patient satisfaction with anesthesia (Table 4). The median duration of pain-free period after spinal anesthesia was 2.4 h (interquartile range 2-3.1) in the height/weight-based group and 2.8 h (interquartile range 2.2-3.55) in the height-based group (*P* = 0.068).

Table 4. Intraoperative maternal hemodynamics, quality of anesthesia, and neonatal outcome

Variables	Height/weight-based group (n = 56)	Height-based group (n = 56)	*P*-value
Pre-delivery lowest SBP (mmHg)	100.9 ± 13.5	103.9 ± 12.1	0.214
Post-delivery lowest SBP (mmHg)	104.8 ± 10.7	105.9 ± 9.7	0.556
Total phenylephrine used (μg)	50 (0-200)	100 (0-200)	0.247
Lowest heart rate (beats/min)	69.7 ± 9.2	71.5 ± 8.4	0.292
Quality of anesthesia			0.067
Excellent	33 (58.93)	34 (60.71)	
Good	15 (26.79)	20 (35.71)	
Fair	2 (3.57)	2 (3.57)	
Poor	6 (10.71)	0 (0)	
Operating condition			0.847
Very good	33 (58.93)	35 (62.50)	
Good	22 (39.29)	21 (37.50)	
Poor	1 (1.79)	0 (0)	
Patient satisfaction with anesthesia, NRS score*	8 (7-9.5)	8 (8-10)	0.542
Neonatal APGAR score (1 min)	7 (7-8)	7 (7-8)	0.697
Neonatal APGAR score (5 min)	9 (8-9)	9 (8-9)	0.604

Values are in mean ± SD, median (interquartile range) and number (percentage)
Abbreviation: NRS, Numeric rating scale
**Using a 0-10 cm scale, with "very dissatisfied" at 0 cm and "very satisfied" at 10 cm*

DISCUSSION

This trial showed that among parturients with short stature, the incidence of post-spinal hypotension and post-delivery hypotension was not significantly different between those who received IT bupivacaine adjusted to height combined with weight, and those who received IT bupivacaine adjusted to height only. We found that patients in the height-based group were less likely than height/weight-based group patients to receive rescue analgesics for intraoperative pain.

Administration of unadjusted spinal local anesthetic doses in short stature parturients is likely to produce hemodynamic instability and a high spinal block. Because unfavorable perinatal outcomes, such as low Apgar scores, are observed in short parturients, any further impairment of uteroplacental perfusion due to hypotension may worsen neonatal outcomes [13]. Therefore, lowering the spinal LA doses in short parturients seems prudent. The LA doses for spinal anesthesia based on patient characteristics are lower than conventional doses,

and these have been shown to produce less maternal hypotension [7-9]. In line with this, we compared two spinal anesthesia dosing regimens based on either height alone or height combined with weight in parturients with heights < 150 cm.

Our study revealed that the intrathecal bupivacaine doses based on height were significantly higher than those based on both height and weight. This difference in dosing is likely due to the linear increase in doses based on height, while doses based on weight are inversely related. This assumption is supported by a population model study that demonstrated a significant correlation between patient height and weight with spinal block characteristics [14]. Despite the differences in the dosing, we did not observe a significant difference in the incidence of hypotension between the two groups. However, Siddiqui and his colleagues found that the incidence of hypotension was significantly higher in the height-based dosing group compared to the height/weight-based dosing group [10]. In their study, the mean height in the height-based group was 155.8 cm, while it was 159.4 cm in the height/weight-based group. Therefore, the significant difference in the patient height may have contributed to hypotension, as previous research has shown a correlation between patient height and hypotension [15, 16]. The other explanation may be due to the different baricities of the bupivacaine used for spinal anesthesia. Unlike the previous study [10] where isobaric bupivacaine was administered, we used a hyperbaric solution. Apart from maternal hypotension, none of the patients in either group developed bradycardia (HR < 50 beats/min). Therefore, in terms of hemodynamic stability, both the regimens of height-based and height/weight-based dosing are appropriate in short parturients.

Lower doses of LA used in single-shot spinal anesthesia may compromise the quality of intraoperative analgesia/anesthesia. A meta-analysis published in 2011 which included 693 participants, reported that the rescue analgesia needed for cesarean section was threefold higher in the low dose group (≤ 8 mg intrathecal hyperbaric bupivacaine) than in the conventional dose group (> 8 mg) [6]. Interestingly, 5% of the 376 patients in the conventional dose group still complained of intraoperative pain. It reflects that we are yet to find the optimal lower doses of intrathecal hyperbaric bupivacaine for CS that produces good intraoperative hemodynamic stability with no compromise in the quality of analgesia. In our study, although both the groups had mean doses of hyperbaric bupivacaine > 8 mg, 11% of the patients in the height/weight-based group required fentanyl supplementation as compared to none in the height-based group. This difference is likely attributed to the higher doses of the bupivacaine administered in the height-based regimen than in the height/weight-based regimen (8.73 mg vs. 8.33 mg). Our observations have indicated that administering a mean difference of 0.40 mg spinal bupivacaine led to a significant decrease in intraoperative pain in the height-based group, while maintaining similar hemodynamics to the height/weight-based group. However, we cannot establish a direct causal link between this association and the observed outcomes. Nevertheless, our findings suggest that for short parturients, using height-based dosing offers the optimal balance between providing effective pain relief during the surgery and reducing the potential for hemodynamic instability.

The ED95 of spinal hyperbaric bupivacaine with an added 10 μg fentanyl for cesarean section in western parturients is 11.2 mg [5]. This dose may be higher for the Asian counterparts because of the differences in body habitus between Western and Asian women. A study in Japanese parturients found that 8 mg of hyperbaric bupivacaine was sufficient to produce adequate analgesia with a lower incidence of hypotension [17]. Likewise, the incidence of hypotension in shorter parturients who received a fixed dose of spinal LA was higher than in the taller group [16]. Whether there is a correlation between height or weight and the spread of bupivacaine in term parturients undergoing cesarean section remains a matter of debate [18, 19]. However, from the patients' safety point of view, it may be necessary to manipulate the neuraxial LA doses in smaller frame pregnant women.

LIMITATIONS

This study has several limitations. First, the trial was conducted in a Nepalese population, thus limiting its generalizability. Second, we had to exclude patients with heights less than 140 cm because the bupivacaine doses for this group of patients were not available in the chart by Harten and colleagues. As a result, we could only study a narrow range of patients with heights between 149 and 140 cm. Third, due to variation in maternal ethnographic origin, there is no uniformity in the cut-off points of heights for identifying short stature women. We defined parturients with heights less than 150 cm as short stature because adverse obstetric outcomes are reported in Nepalese parturients with heights < 150 cm as compared to those with heights > 150 cm [20]. At last, although recommended in most guidelines, we did not use the prophylactic phenylephrine infusion to counter post-spinal hypotension. However, unlike most studies that used post-spinal hypotension definition as SBP < 80% of baseline, we defined our primary outcome, as a SBP < 90% of baseline.

CONCLUSION

Our study found that in short-statured parturients undergoing cesarean section, the effect of a height-based regimen for spinal anesthesia on post-spinal hypotension did not differ from a height/weight-based regimen. However, the height/weight-based group required intraoperative rescue analgesia more frequently. Therefore, administering spinal anesthesia based on the height in a short-statured women can offer a favorable balance between ensuring pain-free anesthesia during a cesarean section while minimizing the possibility of hemodynamic instability.

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