Incidence of Maternal Hypotension under Spinal Anesthesia using Right Lumbar Wedge Compared to Supine Position during Cesarean Section

Jedsadayoot Sakaroonchai MD*,
Phark Thanphraisan MD*, Parichat Curry MD*

** Department of Anesthesiology, Faculty of Medicine, Thammasat University Hospital, Thammasat University, Pathumthani, Thailand*

Objective: *Left uterine displacement with right lumbar wedge has been used to decrease incidence and severity of maternal hypotension and to improve neonatal outcome. However, a recent systematic review shows no clear evidence of benefit. The aim of the study was to evaluate the role of using a right lumbar wedge after spinal anesthesia in the incidence of perioperative maternal hypotension during cesarean delivery.*

Material and Method: *Two hundred healthy women undergoing elective cesarean section were randomly allocated immediately after spinal block to either a 15 degree of right lumbar-pelvic wedge position (Wedge group, n = 100) or supine position (Supine group, n = 100). Hemodynamic values, vasopressor requirements, neonatal APGAR score and umbilical blood pH were collected.*

Results: *The incidences of hypotension were similar (81.63% in Wedge group vs. 79.17% in Supine group, p = 0.856). There were no differences in the lowest systolic and mean blood pressure, intraoperative fluid, vasopressor requirements, neonatal APGAR score and umbilical blood pH.*

Conclusion: *The use of a fifteen-degree right lumbar-pelvic wedge, when compared to complete supine position, was not effective in reducing the incidence of hypotension in spinal anesthesia for cesarean delivery.*

Keywords: *Left uterine displacement, Right lumbar wedge, Cesarean section, Spinal anesthesia, Hypotension*

J Med Assoc Thai 2017; 100 (Suppl. 5): S114-S118
Full text. e-Journal: *http://www.jmatonline.com*

Maternal hypotension after spinal anesthesia for cesarean section remains the commonest serious problem leading to both maternal and neonatal morbidity[1-5]. It is caused by sympathetic block and aortocaval compression by the gravid uterus, which leads to pooling of blood in the lower extremities, preload reduction and hemodynamic compromise[6-9].

Left uterine displacement with right lumbar wedge has been used to decrease maternal hypotension and improve neonatal outcome[10]. However a recent systematic review included both general and regional anesthesia[11] and previous study[12] show no clear evidence to support or disprove the use of left uterine displacement compared to supine position.

In our daily clinical practice, some anesthesiologists use a wedge under the right lumbar area to promote left uterine displacement. The aim of the study was to evaluate the role of a right lumbar wedge during cesarean delivery under spinal anesthesia in the incidence of perioperative maternal hypotension.

Correspondence to:
Sakaroonchai J, Department of Anesthesiology, Thammasat University Hospital, 95 Paholyothin Road, Klongluang, Pathumthani 12120, Thailand.
Phone: +66-81-4453572
E-mail: jed_v6@hotmail.com

Material and Method

Institutional ethics committee approval was obtained for this prospective, randomized study. After obtaining written informed consent, 200 American Society of Anesthesiologists (ASA) physical status class II term singleton pregnancy scheduled for elective cesarean section were enrolled. Exclusion criteria included obesity (body weight over 100 kg), multiple gestation, pregnancy-induced hypertension, chronic hypertension, diabetes, heart disease, age less than 18 years old and patients with contraindications to spinal anesthesia. All patients were not allowed anything orally 8 hours before surgery received Ringer's lactate solution was given as maintenance fluid.

In the operating room, electrocardiography (EKG), non-invasive blood pressure and pulse oximetry

(SpO_2) were monitored. Baseline arterial blood pressure, heart rate and pulse oximetry were measured. Oxygen was given via nasal cannula at 3 L/min and 500 ml of Ringer's lactate solution was administered before spinal anesthesia. Spinal anesthesia was performed at the L3-4 or L4-5 interspace using a 27G Quincke needle. All subjects received 0.5% hyperbaric bupivacaine 2.0 ml with morphine 0.2 mg (total volume 2.2 ml). Immediately after intrathecal injection, those randomly allocated to Wedge group were placed in the supine position with the right lumbar-pelvic wedge and those in the Supine group laid in the supine position without wedge. Groups were assigned by computer generated randomization. The wedge was made of rubber and covered with leather, 30 cm wide and 56 cm long with 15 degree of inclination. It was placed at the right posterior–superior iliac crest at lumbar region of patient. Ringer's lactate solution was infused at a rate of 120 ml/h throughout the surgical procedure. Anesthetic level of sensory blockade was assessed using loss of cold sensation. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and heart rate (HR) were recorded every minute until the baby was delivered, then every five minutes throughout the surgery. Maternal hypotension (systolic blood pressure <90 mmHg or less than 80% of baseline value) was managed with intravenous boluses of 6 mg ephedrine until systolic blood pressure was restored to >90 mmHg and bradycardia (heart rate <60 beats/min) was treated with intravenous bolus doses of 0.6 mg atropine. After placental delivery, blood from umbilical artery was collected for fetal blood-gas analysis. APGAR scores were documented at 1, 5 and 10 minutes by a pediatrician blinded to the groups. Intraoperative complication such as high spinal block, total spinal block and desaturation (SpO_2 <90%) were recorded.

Statistical analysis

Data analyses were performed by an independent researcher who was blinded to the study interventions. The primary outcome was the incidence of hypotension during surgery. Secondary outcomes were vasopressor requirements and neonatal outcome. Power analysis revealed that 92 cases were required to show a decrease in the cumulative incidence of hypotension from 50%[12] to 30% between groups with α level of 0.05 and β level of 0.2 using a two-tailed test. A possible dropout rate of ten percent was anticipated. One hundred patients were required in each group. Continuous data were reported as mean ($\pm$SD) and categorical data were reported as numbers and percentages. Nonparametric data were reported as median and interquartile range (IQR). Data between groups were compared using the Student's t-test, Mann-Whitney U test, chi square test and Fisher's exact test as appropriate. In all cases, $p<0.05$ was considered significant. All analyses and graphs were performed using the computer programs SPSS (version 15; Chicago, IL).

Results

Two hundred patients were enrolled in the study, with 100 in each group. Six patients (two patients in Wedge group and four patients in Supine group) were excluded from the study due to inadequate sensory block necessity to convert to general anesthesia. There were no significant differences in demographic data, the extent of sensory blockade, baseline systolic and mean blood pressure, heart rate, SpO_2 between groups (Table 1).

The incidences of hypotension were similar (81.63% in Wedge group vs. 79.17% in Supine group, $p = 0.856$). There were no differences in the lowest systolic and mean BP, intraoperative fluid, intraoperative blood loss, intraoperative complications, vasopressor requirements, neonatal APGAR score and umbilical blood pH (Table 2, 3).

Discussion

The incidences of maternal hypotension after spinal anesthesia in Wedge and Supine group in current study were similar (81.63% vs. 79.17%). Intraoperative vasopressor consumptions, neonatal APGAR score and umbilical blood pH were also not significantly different. These results correspond to the recent systemic review[11] including patients anesthetized by general anesthesia and spinal anesthesia which concluded that there was no significant benefits from any interventions including wedge and 15 degree-tilt.

The hypothesis of this study was adjusting the position using right lumbar-pelvic wedge may prevent aortocaval compression in pregnant women after spinal anesthesia. Higuchi et al[13] used magnetic resonance imaging(MRI) to study the effect of left-lateral tilt positions (15°, 30° and 45° angle) on the volume of abdominal aorta and inferior vena cava in pregnant compared to non-pregnant women. They found that aortic volume did not differ significantly between pregnant and non-pregnant women in supine position and left-lateral tilt positions. Inferior vena cava volume in the supine position was significantly lower

Table 1. Patient Baseline Characteristics

	Wedge group (n = 98)	Supine group (n = 96)	*p*-value
Age (year)	30.69 (±5.32)	30.42 (±4.74)	0.702
Weight (kg)	70.54 (±9.62)	69.27 (±10.67)	0.386
Height (cm)	158.46 (±5.14)	158.99 (±6.19)	0.517
Sensory block level	T4 (T3-T6)	T4 (T3-T6)	0.497
Baseline systolic BP (mmHg)	120.23 (±8.91)	118.75 (±10.33)	0.265
Baseline mean BP (mmHg)	89.69 (±6.96)	88.83 (±6.72)	0.383
Baseline heart rate (bpm)	85.67 (±9.09)	85.05 (±8.25)	0.619
Baseline SpO_2 (%)	98.59 (±0.86)	98.60 (±0.76)	0.916

Data are mean (±SD), median [range] or number;

Table 2. Intraoperative parameters and outcomes

	Wedge group (n = 98)	Supine group (n = 96)	*p*-value
Uterine incision to delivery time (minutes)	2.57 (±2.02)	2.30 (±1.56)	0.300
Intraoperative fluid (mL)	967.94 (±223.25)	969.27 (±208.55)	0.805
Intraoperative blood loss (mL)	327.04 (±110.57)	327.39 (±93.46)	0.980
Injection to delivery time (min)	12.30 (±3.40)	11.48 (±4.18)	0.137
Incidence of hypotension	80/98 (81.63%)	76/96 (79.17%)	0.856
Lowest SBP (mmHg)	88.14 (±11.29)	85.45 (±13.54)	0.134
Lowest DBP (mmHg)	49.27 (±8.63)	47.69 (±10.51)	0.254
Ephedrine consumption (mg)	16.4 (±7.9)	15.8 (±7.3)	0.57
Norepinephrine consumption (mcg)	7.3 (±4.2)	8.3 (±4.6)	0.15
Intraoperative complication	0	0	1.000

Data are mean (±SD), median [range] or number

Table 3. Neonatal Outcomes

	Wedge group (n = 98)	Supine group (n = 96)	*p*-value
APGAR score at 0 minute	9	9	1.000
APGAR score at 5 minute	10	10	1.000
Neonatal weight (g)	3,180.33 (±349.05)	3,224.31 (±355.62)	0.390
Umbilical blood pH	7.34 (±0.068)	7.35 (±0.058)	0.254

Data are mean (±SD), median [range] or number

in pregnant than in non-pregnant women and was not increased at 15° but was significantly increased at 30°. Nonetheless, this inferior vena cava compression did not affect maternal hemodynamics. They also demonstrated no alterations in cardiac output, heart rate or mean arterial pressure related to the degree of lateral tilt. However, this study was performed in non-anesthetized parturients when abdominal muscle relaxation and vasodilatation were not taken into account. The incidence of maternal hypotension in both groups were not difference may be explained from this study. The present study using the usual procedures of routine practice for cesarean section in Thailand; a 15 degree-tilt using the most acceptably recommended Crawford-wedge[10]. Lateral tilt at 30° was not performed because it is inconvenient for surgical approach.

Current evidence suggests employing the preloading, co-loading fluid and vasopressor infusion for prevention of hypotension during cesarean section with spinal anesthesia[14,15] but in this study used only preloading fluid for prevent hypotension because that was the routine practice in Thailand.

Despite a high incidence of maternal hypotension during cesarean delivery, term infants tend to tolerate the physiological insult without major sequelae[16] similar to this study which showed normal neonatal APGAR score and umbilical blood pH in both groups.

There were two major limitations of the present study. First, the included parturients were healthy, non-obese and non-complicated pregnancy. In parturients with obesity, pregnancy-induced hypertension or other complications of pregnancy, the results may be difference. Second, the complications from laying in the supine with wedge such as back pain, neuropathy were not recorded in this study.

Conclusion

In this study, the use of a fifteen-degree right lumbar–pelvic wedge compared to the complete supine position was not effective in reducing the incidence of hypotension in spinal anesthesia for cesarean delivery.

What is already known on this topic?

Maternal hypotension after spinal anesthesia for cesarean section remains the commonest serious problem leading to both maternal and neonatal morbidity. Left uterine displacement with right lumbar wedge has been used to decrease incidence and severity of maternal hypotension and to improve neonatal outcome. However, a recent systematic review shows no clear evidence of benefit.

What this study adds?

Left uterine displacement with fifteen-degree right lumbar-pelvic wedge compared to the complete supine position was not effective in reducing the incidence of hypotension in spinal anesthesia for elective cesarean delivery.

Acknowledgement

This study was supported by grants from the Faculty of Medicine, Thammasat University.

Potential conflicts of interest

None.

References

1. Cyna AM, Andrew M, Emmett RS, Middleton P, Simmons SW. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev 2006; (4): CD002251.
2. Morgan PJ, Halpern SH, Tarshis J. The effects of an increase of central blood volume before spinal anesthesia for cesarean delivery: a qualitative systematic review. Anesth Analg 2001; 92: 997-1005.
3. Corke BC, Datta S, Ostheimer GW, Weiss JB, Alper MH. Spinal anaesthesia for Caesarean section. The influence of hypotension on neonatal outcome. Anaesthesia 1982; 37: 658-62.
4. Marx GF, Cosmi EV, Wollman SB. Biochemical status and clinical condition of mother and infant at cesarean section. Anesth Analg 1969; 48: 986-94.
5. Rout CC, Rocke DA. Prevention of hypotension following spinal anesthesia for cesarean section. Int Anesthesiol Clin 1994; 32: 117-35.
6. Holmes F. Spinal analgesia and caesarean section; maternal mortality. J Obstet Gynaecol Br Emp 1957; 64: 229-32.
7. Scott DB. Inferior vena caval occlusion in late pregnancy and its importance in anaesthesia. Br J Anaesth 1968; 40: 120-8.
8. Courtney L. Supine hypotension syndrome during caesarean section. Br Med J 1970; 1: 797-8.
9. Ngan Kee WD. Uteroplacental blood flow. In: Chestnut DH, Polley LS, Tsen LC, Wong CA, editors. Obstetric anesthesia principles and practice. 4th ed. Philadelphia: Mosby Elsevier; 2009: 37-53.
10. Crawford JS, Burton M, Davies P. Time and lateral tilt at Caesarean section. Br J Anaesth 1972; 44: 477-84.
11. Cluver C, Novikova N, Hofmeyr GJ, Hall DR. Maternal position during caesarean section for preventing maternal and neonatal complications. Cochrane Database Syst Rev 2010; (6): CD007623.
12. Calvache JA, Munoz MF, Baron FJ. Hemodynamic effects of a right lumbar-pelvic wedge during spinal anesthesia for cesarean section. Int J Obstet Anesth 2011; 20: 307-11.
13. Higuchi H, Takagi S, Zhang K, Furui I, Ozaki M. Effect of lateral tilt angle on the volume of the abdominal aorta and inferior vena cava in pregnant and nonpregnant women determined by magnetic resonance imaging. Anesthesiology 2015; 122: 286-93.
14. Dyer RA, Reed AR. Spinal hypotension during elective cesarean delivery: closer to a solution. Anesth Analg 2010; 111: 1093-5.
15. Allen TK, George RB, White WD, Muir HA, Habib AS. A double-blind, placebo-controlled trial of four fixed rate infusion regimens of phenylephrine for

hemodynamic support during spinal anesthesia for cesarean delivery. Anesth Analg 2010; 111: 1221-9.
16. Maayan-Metzger A, Schushan-Eisen I, Todris L, Etchin A, Kuint J. Maternal hypotension during elective cesarean section and short-term neonatal outcome. Am J Obstet Gynecol 2010; 202: 56-5.

การเปรียบเทียบอุบัติการณ์ของภาวะความดันโลหิตต่ำในสตรีตั้งครรภ์ที่ได้รับการผ่าตัดคลอดภายใต้การระงับความรู้สึกด้วยการฉีดยาชาเข้าที่ช่องน้ำไขสันหลังในกลุ่มที่หนุนหมอนรูปลิ่มเปรียบเทียบกับกลุ่มนอนหงาย

เจษฎายุทธ ศักดิ์อรุณชัย, ภาคย์ ธารไพรสาณฑ์, ปริฉัตร เคอรี่

วัตถุประสงค์: *การหนุนหมอนรูปลิ่มเป็นวิธีที่ยอมรับและใช้กันแพร่หลายในการช่วยลดอุบัติการณ์การเกิดความดันโลหิตต่ำและส่งผลดีต่อทารกแรกเกิด ถึงอย่างไรก็ตามยังไม่มีงานวิจัยที่ชัดเจนที่มาสนับสนุนว่าช่วยลดอุบัติการณ์นี้ ดังนั้นผู้นิพนธ์สนใจศึกษาถึงผลของการหนุนหมอนรูปลิ่มต่ออุบัติการณ์การเกิดความดันโลหิตต่ำในการผ่าตัดคลอดภายใต้การระงับความรู้สึกด้วยการฉีดยาชาเข้าที่ช่องน้ำไขสันหลัง*

วัสดุและวิธีการ: *สตรีตั้งครรภ์จำนวน 200 คน ที่ได้รับการผ่าตัดคลอด ได้รับการแบ่งกลุ่มแบบสุ่มหลังจากได้รับการระงับความรู้สึกด้วยการฉีดยาชาเข้าที่ช่องน้ำไขสันหลังเป็น 2 กลุ่ม คือกลุ่มที่หนุนหมอนรูปลิ่มเอียง 15 องศา 100 คนและกลุ่มนอนหงาย 100 คน ทำการเก็บข้อมูล ได้แก่ ความดันโลหิตและระบบไหลเวียนเลือด ปริมาณยาเพิ่มความดันที่ใช้ประเมินทารกแรกเกิดโดยดูค่าคะแนน APGAR และค่าความเป็นกรดของเลือดที่ดูดจากเส้นเลือดแดงของสายสะดือ*

ผลการศึกษา: *อุบัติการณ์การเกิดความดันโลหิตต่ำทั้งสองกลุ่มไม่มีความแตกต่างกัน (81.63% ในกลุ่มที่หนุนหมอนรูปลิ่มและ 79.17% ในกลุ่มนอนหงาย, p = 0.856) และไม่มีความแตกต่างกันในค่าของความดันโลหิต ปริมาณสารน้ำที่ได้รับยาเพิ่มความดันที่ได้รับคะแนน APGAR ของทารกแรกเกิด และค่าความเป็นกรดของเลือดที่ดูดจากเส้นเลือดแดงของสายสะดือ*

สรุป: *การหนุนหมอนรูปลิ่มเอียง 15 องศา ไม่มีผลต่อการลดอุบัติการณ์ภาวะความดันโลหิตต่ำในการผ่าตัดคลอด ภายใต้การระงับความรู้สึกด้วยการฉีดยาชาเข้าที่ช่องน้ำไขสันหลังเมื่อเทียบกับกลุ่มนอนหงาย*
