E-ISSN 2250-0944

ISSN 2250-1150

doi: 10.48047/ijprt/15.02.302

Research Article

Comparison of Onset of Sensory Block and Height of Sensory Block when Subarachnoid Block is Performed at L2-L3 versus L3-L4 level in Obstetric Patients undergoing Caesarean Section

Yusra Arshad Shahani[1*], Muhammad Zaheer Ud Din[2], Humaira Jadoon[3], Aadrish Hadeed Shahani[4]

[1]Capital Hospital Islamabad, Pakistan
[2]CMH Mardan, Pakistan
[3]KRL Hospital, Islamabad, Pakistan
[4]Rawalpindi International Hospital, Rawalpindi, Pakistan

*Corresponding author's email: yusrashahani1@gmail.com

ABSTRACT

Introduction: During caesarean section, the level required for skin incision for caesarean section is the T10 dermatome, however, traction of intraperitoneal organs result in intraoperative visceral pain which can cause discomfort, nausea, vomiting to the patient, therefore it necessitates the need of adequate blockade of T4 sensory level.

Objectives: To evaluate subarachnoid block at L2-L3 vs L3-L4 level in terms of mean time of onset of sensory block and frequency of highest dermatomal level of sensory block in obstetric patients undergoing caesarean section.

Methodology: A total of 60 women undergoing cesarean section under spinal anesthesia between 18-45 years of age were included. Patients with relative or absolute contra-indication to spinal anesthesia and obstetrics emergencies were excluded. Patients were randomly allocated to either of the two groups H and L according to computer generated numbers. In patients of group H, higher space i.e. L2-L3 was selected for spinal injection whereas in group L, lower space i.e. L3-L4 was selected for spinal injection. Although the patients were monitored continuously but height of block was recorded at appropriate intervals as mentioned in the proforma, for study purpose. Final outcome in the form of height of block was recorded at 20 minutes of ensuring spinal block.

Results: In my study, the mean time of onset of sensory block was 7.0 ± 1.38 and 7.25 ± 1.37 min in group H and L respectively with P value 0.484, the time of onset of sensory block in group L was delayed insignificantly as compared to group H.

Conclusion: This study concluded that in patients undergoing caesarean section, spinal block performed at L2-L3 interspace provides superior analgesia, significantly earlier onset of sensory block as compared to spinal anesthesia administered at L3-L4 vertebral interspace.

Keywords: spinal anesthesia, interspace, onset of sensory block.

INTRODUCTION

Spinal anesthesia has become one of the most preferred type of anesthesia in current anesthesia practice, it is used in a wide number of surgeries including lower abdominal and pelvic surgeries, lower extremity surgery, urology, obstetric and gynecologic procedures.[1] Spinal anesthesia as compared to general anesthesia has reduced mortality, cardiovascular morbidity, lower incidence of deep venous thrombosis, pulmonary embolism, reduced intraoperative blood loss, opioid related adverse effects, duration of surgery, cognitive effects, respiratory depression and pneumonia.[2] Spinal anesthesia also improves rehabilitation as compared to general anesthesia.[1] The benefits seem to be collated by multifactorial mechanisms, including increased blood flow, altered coagulation, improved ability to breathe free of pain, and reduction in surgical stress response.[2] There is an increasing trend in caesarean section rates globally.[3] Regional anesthesia has become the preferred technique for caesarean sections over the past decades for both maternal and fetal better outcomes.[4] Failed tracheal intubation, risk of aspiration and related aspiration pneumonitis are the most fearful complications associated with general anesthesia during caesarean deliveries.[5, 6] For both planned and emergency caesarean deliveries, there is an increased risk of neonatal intubation after general anesthesia and there is also an increased possibility that APGAR5 score would be <7 in intubated neonates delivered after general anesthesia as compared to infant intubated after regional anesthesia.[7] Also spinal anesthesia provides effective pain control, early mobilization and early return to routine activities for new mothers and increase their quality of life.[8] Moreover among regional anesthetic techniques, spinal anesthesia is preferred over epidural anesthesia because of its cost effectiveness, predictability and denser block.[9]

METHODOLOGY

This randomized controlled trial was conducted at the Anesthesia Department of Kahuta Research Laboratories Hospital in Islamabad from April 30, 2021, to October 29, 2021. The sample size was determined using the WHO Sample Size Calculator, with a 5% significance level, 80% test power, a population standard deviation of 1.35, a test population mean of 7.1, and an anticipated population mean of 9.5. This resulted in 30 participants per group, yielding a total sample size of 60. Consecutive non-probability sampling was used for participant selection.

Eligible participants included pregnant females between 18 and 45 years of age undergoing elective cesarean delivery, classified as ASA physical status II, and with a Body Mass Index (BMI) between 18 and 35 kg/m². Exclusion criteria encompassed any contraindication to spinal anesthesia, ASA status III or higher, and obstetric emergencies. After ethical approval, patients meeting these criteria were enrolled and randomly assigned to one of two groups—H or L—using computer-generated numbers. In group H, spinal injection was administered at the L2–L3 interspace, while in group L, the L3–L4 interspace was used.

All patients had two 18-gauge intravenous lines inserted, one infusing Ringer's lactate and the other Haemaccel. Standard monitoring was applied, including ECG, heart rate, non-invasive blood pressure, and SpO_2, with baseline readings recorded. Tuffier's line served as the anatomical landmark for identifying the correct spinal space. The same trainee researcher, experienced in over 200 spinal blocks, performed all procedures. Each patient received 2.1 mL (11 mg) of 0.5% hyperbaric bupivacaine intrathecally over 20 seconds after confirmation of free cerebrospinal fluid flow. Patients were immediately positioned supine with a pillow under the head and a wedge under the right buttock and received oxygen via face mask at 2 L/min.

The onset time of spinal anesthesia was recorded from the completion of the intrathecal injection. Sensory block height was assessed by loss of pinprick sensation along the abdominal midline,

starting from T12 and moving cephalad. Surgery commenced once a T6 sensory block level was achieved. For study purposes, block height was recorded at predefined intervals, with the final outcome measured at 20 minutes post-injection. Patients were continuously monitored throughout surgery. Cases of failed or inadequate spinal anesthesia were converted to general endotracheal anesthesia.

Data analysis was performed using SPSS version 22. Descriptive statistics were used for qualitative and quantitative variables. Qualitative variables such as ASA status were reported as frequencies, while quantitative variables such as age, weight, height, and time to sensory block onset were expressed as mean ± standard deviation. The independent samples t-test was used to compare the time of onset of sensory block between groups, with a p-value of less than 0.05 considered statistically significant.

RESULTS

Age range in this study was from 18 to 45 years with mean age of 29.65 ± 3.93 years. The mean age of patients in group A was 29.03 ± 4.13 years and in group B was 29.77 ± 3.86 years. Majority of the patients 38 (63.33%) were between 18 to 30 years of age as shown in Table I. Mean weight of patients was 75.53 ± 7.31 kg. Mean height was 162.33 ± 9.89 cm. Mean BMI was 28.53 ± 7.31 kg/m^2 (Table II). ASA status of patients in both groups is shown in Table III.

In my study, the mean time of onset of sensory block was 7.0 ± 1.38 and 7.25 ± 1.37 min in group H and L respectively with P value 0.484, the time of onset of sensory block in group L was delayed insignificantly as compared to group H (Table IV). Comparison of subarachnoid block at L2-L3 vs L3-L4 level in terms of frequency of highest dermatomal level of sensory block in obstetric patients undergoing caesarean section is shown in Table V.

Table-I: Age distribution for both groups (n=60).

	Group H (n=30)		Group L (n=30)		Total (n=60)	
Age (years)	No. of patients	%age	No. of patients	%age	No. of patients	%age
18-30	20	66.67	18	60.0	38	63.33
31-45	10	33.33	12	40.0	22	36.67
Mean ± SD	29.03 ± 4.13		29.77 ± 3.86		29.65 ± 3.93	

Table-II: BMI of patients in both groups (n=60).

	Group H (n=30)		Group L (n=30)		Total (n=60)	
BMI (kg/m^2)	No. of patients	%age	No. of patients	%age	No. of patients	%age
≤25	10	33.33	12	40.0	22	36.67
>25	20	66.67	18	60.0	38	63.33
Mean ± SD	28.87 ± 6.88		28.20 ± 7.82		28.53 ± 7.31	

Table-III: ASA status of patients in both groups (n=60).

	Group H (n=30)		Group L (n=30)		Total (n=60)	
ASA	No. of patients	%age	No. of patients	%age	No. of patients	%age
II	30	100.0	30	100.0	60	100.0
III, IV, V	00	0.0	00	0.0	00	0.0

Table-V: Comparison of subarachnoid block at L2-L3 vs L3-L4 level in terms of mean time of onset of sensory block in obstetric patients undergoing caesarean section.

	Group H (n=30)	Group L (n=30)	p-value
	Mean ± SD	Mean ± SDn	
Time of onset of sensory block (min)	7.0 ± 1.38	7.25 ± 1.37	0.484

Table VI: Comparison of subarachnoid block at L2-L3 vs L3-L4 level in terms of frequency of highest dermatomal level of sensory block in obstetric patients undergoing caesarean section.

		Group H (n=30)		Group L (n=30)	
		No. of Patients	%age	No. of Patients	%age
Final block level (at 20 min)	High	25	83.33	12	40.0
	Target	05	16.67	17	56.67
	Lower	00	0.0	01	3.33

- P-value = 0.0023 which is statistically significant.

DISCUSSION

The rate of C-section has risen to 22% according to recent Pakistan demographics and Health Survey of 2017-2018.[10], it's the highest ever in the history of Pakistan. Dealing with pregnant patient is quite challenging for the anesthetist as it is a matter of wellbeing of both mother and the fetus. That is why an anesthetist is responsible for planning such an anesthetic technique which is favorable for both mother and the baby. Regional anesthesia is preferred over general anesthesia for caesarean sections for both maternal and fetal better outcomes.[4] General anesthesia is not preferred because of airway problems in obstetric population leading to failed tracheal intubation, along with risk of aspiration of gastric contents and related aspiration pneumonitis, these all are deadly complications of general anesthesia.[5,6] Moreover, the neonatal outcome is also better in caesarean deliveries after regional anesthesia than with general anesthesia. Also spinal anesthesia provides good pain control, early mobilization and early return to routine activities for new mothers increasing their quality of life.[8] Spinal anesthesia is preferred over epidural anesthesia because of predictability, also it is single shot, produces dense blockade and is cost effective.[9]

The level required for skin incision for caesarean section is the T10 dermatome, but traction of intraperitoneal organs produces intraoperative visceral pain which causes discomfort, nausea and vomiting to the patient, so it is necessary to attain the sensory block level of T4 dermatome.[11] However block levels greater than T4 may result in hemodynamic compromise while lower levels cause maternal discomfort intraoperatively.[12]

Spinal anesthesia remains popular for various types of surgery, mainly obstetric, but also for orthopedic and surgery in the lower abdomen, including inguinal hernia repair. When we compare spinal anesthesia to general anesthesia, spinal anesthesia has reduced mortality, cardiovascular morbidity, pulmonary embolism, reduced intraoperative blood loss, opioid related adverse effects, duration of surgery, cognitive effects, respiratory depression and pneumonia.[2] It also improves

rehabilitation.[1] Height of subarachnoid block is influenced by factors affecting the intrathecal spread of local anesthetics which is determined by multiple factors the most important being the baricity. The other factors affecting the spread of subarachnoid block are immediate patient position, volume and dose of local anesthetic, needle type and alignment, spinal curvature, obesity, speed of injection, lumbosacral CSF volume and fluid currents.[13]

This study revealed that onset of sensory block level is not affected by giving subarachnoid injection at L2-L3 intervertebral space versus L3-L4 intervertebral space, however maximum height of block checked at 20 minutes of injection is statistically significant. Previous studies that compared the effect of different interspaces on onset and height of block are quite controversial. Therefore, we did this study to see if there is in reality any difference in the onset and height of block. Although spinal anesthesia has long been considered as a safe method of regional anesthesia, it is not without risks of side effects and complications. Arterial hypotension is known to occur during spinal anesthesia with an incidence of approximately 33% as well as severe bradycardia with an incidence of 13%.[14] The clinical importance of this side effect was analyzed in a study undertaken by Sanborn et al., who proved that hypotensive episodes detected by an automated record-keeping system clearly correlated with higher mortality.[15] Some authors suggested that performing spinal puncture at L2–3 interspace can result in hypotension , whereas others found that number of hypotensive episodes as well as spread of local anesthetic through subarachnoid space were not significantly different between L2–3 and lower lumbar levels.

Our results of height of spread are similar to the study done by Chin KW and his colleagues who studied the influence of the vertebral interspace and speed of injection on the spread of spinal anesthesia with 0.5% bupivacaine. 3ml of plain 0.5% bupivacaine was injected intrathecally at two different speeds (15 and 30 seconds) in two different spinal interspaces L2/3 and L3/4 in four groups of ten patients each. Injection given in 15 seconds at L2/3 interspace produced a significantly higher mean maximum spread (T6.4) as compared to L4/5 over 15 seconds (T10.3) ($p<0.05$). At the same interspace L2/3, injection given in 15 seconds also produced higher level of spread as compared to 30 sec group ($p<0.05$). We used hyperbaric 0.5% bupivacaine in our study which produces more predictable block than plain bupivacaine being used in this study.[16]

Taivainen T and his coworkers' studied the influence of the vertebral interspace used for injection on the spread of spinal anesthesia with plain 0.5% bupivacaine. 40 ASA I patients aged 22-59 years, scheduled for orthopedic surgery were included in the study. Injection at the L2/3 space produced a significantly higher level of spread (T7) compared to injection at L4/5 (T11). L4/5 group showed lesser cephalic spread of block ($p<0.001$ at 60 min). Anesthesia spread continued till 30 minutes in both groups, one patient developed a final block height of T1 when injection was given at L2/3 followed by temporary fall in arterial blood pressure.[17]

CONCLUSION

This study concluded that in patients undergoing caesarean section, spinal block performed at L2-L3 interspace provides superior analgesia, clinically significant earlier onset of sensory block as compared to spinal anesthesia administered at L3-L4 vertebral interspace and also greater height of block So, we recommend that spinal block performed at L2-L3 interspace should be used routinely in our general practice for achieving earlier onset of sensory block.

REFRENCES

1. Feroze R, Hussain A, Wahid F, Tariq M, Saleem MA, Toor AW. Does 10mg versus 12.5 mg of 0.5% hyperbaric bupivacaine influence the incidence of epigastric discomfort

encountered during caesarean section under spinal anesthesia?. Journal of Rawalpindi Medical College. 2022 Sep 30;26(3).
2. Rodgers A, Walker N, Schug S, McKee A, Kehlet H, Van Zundert A, Sage D, Futter M, Saville G, Clark T, MacMahon S. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. Bmj. 2000 Dec 16;321(7275):1493.
3. Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PloS one. 2016 Feb 5;11(2):e0148343.
4. Alabi AA, Adeniyi OV, Adeleke OA, Pilla P, Haffajee MR. Factors associated with failed spinal anaesthesia for Caesarean sections in Mthatha general hospital, Eastern Cape, South Africa. South African Family Practice. 2017 Aug 29;59(4):128-32.
5. Delgado C, Ring L, Mushambi MC. General anaesthesia in obstetrics. BJA education. 2020 Jun 1;20(6):201-7.
6. Šklebar I, Bujas T, Habek D. Spinal anaesthesia-induced hypotension in obstetrics: prevention and therapy. Acta Clinica Croatica. 2019 Jun;58(Suppl 1):90.
7. Algert CS, Bowen JR, Giles WB, Knoblanche GE, Lain SJ, Roberts CL. Regional block versus general anaesthesia for caesarean section and neonatal outcomes: a population-based study. BMC medicine. 2009 Apr 29;7(1):20.
8. Ghaffari S, Dehghanpisheh L, Tavakkoli F, Mahmoudi H. The effect of spinal versus general anesthesia on quality of life in women undergoing cesarean delivery on maternal request. Cureus. 2018 Dec 11;10(12).
9. Yeoh SB, Leong SB, Heng AS. Anaesthesia for lower-segment caesarean section: Changing perspectives. Indian journal of anaesthesia. 2010 Sep 1;54(5):409-14.
10. Khowaja B, Mughal FB, Valliani K. The factors influencing cesarean-section rates-a narrative review from Pakistan. Pakistan Journal of Medical Research. 2021 Oct 25;60(3):143-7.
11. Lu Q, Dong CS, Yu JM, Sun H, Sun P, Ma X, Luo C. The dose response of sufentanil as an adjuvant to ropivacaine in cesarean section for relief from somato-visceral pain under epidural anesthesia in parturients with scarred uterus. Medicine. 2018 Sep 1;97(38):e12404.
12. Tuominen M, Taivainen T, Rosenberg PH. Spread of spinal anaesthesia with plain 0.5% bupivacaine: influence of the vertebral interspace used for injection. British Journal of Anaesthesia. 1989 Apr 1;62(4):358-61.
13. Hocking G, Wildsmith JA. Intrathecal drug spread. British journal of anaesthesia. 2004 Oct 1;93(4):568-78.
14. Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anesthesia. Anesthesiology. 1992 Jun 1;76(6):906-16.
15. KV S. Detection of intraoperative incidents by electronic scanning of computerized anesthesia records: comparison with voluntary reporting. Anesthesiology. 1996;85:977-87.
16. Chin KW, Chin NM, Chin MK. Spread of spinal anaesthesia with 0.5% bupivacaine: influence of the vertebral interspace and speed of injection. MEDICAL JOURNAL OF MALAYSIA. 1994 Jun 1;49:142-.
17. Tuominen M, Taivainen T, Rosenberg PH. Spread of spinal anaesthesia with plain 0.5% bupivacaine: influence of the vertebral interspace used for injection. British Journal of Anaesthesia. 1989 Apr 1;62(4):358-61.