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ORIGINAL ARTICLE

Comparison of spinal anesthesia at L3-L4 versus L4-L5 in obstetric patients undergoing Cesarean section at South east hospital and research center.

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ABSTRACT… Objective: To compare the efficacy and safety of spinal anesthesia at the L3-L4 versus L4-L5 intervertebral spaces in obstetric patients undergoing elective C-sections. **Study Design:** Prospective, Randomized Controlled Trial. **Setting:** South East Hospital and Research Center Islamabad. **Period:** January 2023 to December 2023. **Methods:** Included the patients who were scheduled for elective C-sections. The main outcomes included the onset and the duration of sensory block, the degree of sensory blockade achieved, intraoperative hemodynamics, control of postoperative pain, satisfaction of mothers. **Results:** The results indicate that lumbar spinal anesthesia at L3-L4 given to patient results in quicker sensory block when compared to L4-L5 (L3-L4, 65% within 5 mins. Vs. L4-L5, 3.4%) while the effective duration of L4-L5 group was longer (87% between 2 – 2.5 hrs). In addition to this, L3-L4 spinal block achieved a higher level (T4) of sensory block compared to L4-L5 which recorded a lower incidence of hypotension with the L3-L4 group experiencing hypotension at 61.7% compared to only 2% in the L4-L5 group. **Conclusion:** This study indicates that higher levels of the spinal anaesthsia can be attained quicker with the L3-L4 approach but better and longer analgesia is achieved with the L4-L5 level and without compromising hemodynamic stability. This information will be important to the clinicians in determining the best spinal anesthetic level for elective and emergency Cesarean section surgeries enhancing safety of the patients and improving the results.

Key words: C-section (Cesarean Section), Lumbar Spinal Anesthesia, L3-L4 Intervertebral Space, L4-L5 Intervertebral Space, Spinal Anesthesia.

INTRODUCTION

Over the past few decades, the use of Cesarean section (C-section), which is one of the core surgical services, has become immensely prevalent in all the continents. For example, in the United States, about 31.9% of all the deliveries were through C-section in 2018 and this trend is common in other developed and less developed nations.[1] This administration has its usefulness especially due to the well-being of both the mother and child, however, there are risks associated with it which may alter some maternal and neonatal outcomes.[2] The management of anesthesia especially during cesarean section is highly needed for it, as spinal anesthesia not only provides ease and alleviation of pain of the mother but also the wellbeing of the fetus and outcomes of the infant. Among all the anesthesia techniques in addition to their modifications in availability. Spinal anesthesia is the commonest and recommended for elective C-sections due to its quick action and effectiveness while posing little or no risks to the infants.[3] Spinal anesthesia refers to the technique of some local anaesthesia injected in the CSF of the spinal canal, which in turn causes a temporary nerve impulse block and resultant motor as well as sensory loss in the lower half of the body.[4] Despite with this several years of experience some anesthesiologists and obstetricians still argue about the level of intervertebral space to inject the local anesthetic in the lumbar region. Administering spinal analgesia at a predetermined vertebral level is an important aspect of the management of anesthesia of patients undergoing cesarean section (C-section). Moreover, knowing the impact of each spinal

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lumbar level especially L3-L4 and L4-L5 surgeries in the provision of services and achieving good surgical results is paramount to help patients smoothly go through the perioperative period.[5] The lumbar region of the spine is made up of a total of five vertebial segments referred to as L1 to L5. Each of these landmarks has specific architecture and relational geography with the spinal column and nerve roots.

Nowadays, owing to the ease of access, good anatomic landmarks as well as the merits of providing better anesthesia for the lower abdomen and pelvis operations[6], the L3-L4 and L4-L5 disc spaces are the most commonly chosen for spinal anesthesia. Nevertheless, given that many factors such as spinal anatomy, patient position, and technique can interact to alter the extent and effectiveness of the anesthesia, spinal anesthesia for a lumbar region calls for an in-depth knowledge of how it is done across the various levels of the lumbar spine. From this perspective, it would be salient to reach a conclusion regarding spinal anesthesia at L3-L4 and L4- L5 levels in order to improve the delivery of anesthesia, and better the patient welfare and experience during planned C-sections, and surgical interventions.[7] Nevertheless, more recent publications have tended to indicate that there are some advantages in performing spinal anaesthesia at the level of L4-L5 compared to the classical approach at the level of L3-L4. These possible advantages are a decrease in the incidence of unintentional dura puncture, a further decrease in post-dural puncture headache incidence, and enhanced coverage of lower abdominal and pelvic regions for surgical procedures.[9,10]

Though these potential benefits are put forward, quality evidence comparing levels L3-L4 and L4-L5 regarding spinal anesthesia for C-section remains scanty. The bulk of available evidence is composed of review of cases, case series, and few prospective studies with discordant outcomes that are difficult to generalize.[11] It, therefore, follows that there is an urgent call for well designed prospective studies looking into spinal anaesthesia for elective C-section at different lumbar levels in terms of efficacy, safety and patient satisfaction.[12]

This study intends to fill this void in the available literature by performing a prospective randomized controlled trial that compares outcomes involved in spinal anesthesia at the L3-L4 and L4-L5 interspaces during an elective and emergency cesarean section. An emphasis on key endpoints such as anesthetic effectiveness, hemodynamic stability during surgery, effectiveness of pain relief after the procedure. We hope to give a scientific rationale to the recommendation to clinicians on the preferable level of spinal anaesthesia in this situation.

METHODS

This clinical trial study conducted at South East Hospital and Research Center Islamabad, department of gynecology from January 2023 to December 2023, ethical letter no. 011-ERC-SHE dated 18-12-2022,s for the patients who undergone for C-section and receiving spinal anesthesia. Data was collected through structured proforma both open and close ended questions. One hundred and twenty (120) Patients who required elective emergency cesarean section and were administered spinal anesthesia (10 mg of 0.5% bupivacaine) were divided into two groups of 60 patients each: 60 patients who received spinal anesthesia at L3-L4 (group 1) and 60 patients at L4-L5 (group 2). The groups were also examined with respect to: age, weight, heights, level of spinal block, surgical procedure finished time, level of sensory block, degree of motor block, time to sensory level T10, hemodynamic parameters.

Data was entered and Analyzed by SPSS version 26.00. Frequency and percentages were calculated for qualitative variables, e.g. co morbidities, indications for C-section, Onset of sensory and motor block etc, and Mean±SD for quantitative variable e.g. age. For comparison of both groups t-test was applied and considered significant at p value >0.05.

RESULTS

A total of 120 patients included in our study after meeting the inclusion criteria. We selected

randomly for both groups through which 60 in L3-L4and 60 in L4-L5. All the baseline characteristics were assessed and compare the spinal anesthesia presentations of both groups.

Characteristics	L3-L4: n= 60 Mean±SD	L4-L5 n=60 Mean±SD
Age	29.23±3.411	31.38±5.899
Co morbidities	**(n, %)**	**(n,%)**
Hypertension	20(29.41%)	14 (23.33)
Type 2 diabetes mellitus	4 (6%)	4 (6.66)
Both HTN and DM	10(14%)	10 (16.7)
Others	2(3%)	2(3.33)
None	24(47%)	30 (50)
Number of previous pregnancies		
1	10(15)	14 (23)
2	24(35.29)	22 (36.66)
3	18(26.47)	12 (20)
4	10(14.70)	8 (13.33)
5	7(9)	4 (6.66)
Number of previous C-section		
0	24(35.29)	25(41.6)
1	16(26.47)	15(25)
2	12(23.52)	10(16.6)
3	7(11.76)	7(11.6)
4	1(3)	3(5)
Previous Anesthesia History		
Spinal	60(100)	60(100)
Current LCS		
Emergency	28(44.1)	29(48)
Elective	32(55.8)	31(51.6)
Indications		
Polghaydnamnious (complicated)	0 (0)	1 (3)
Breech	8 (11.7)	9 (26.47)
precious pregnancy	4(5.8)	5 (8.33)
Breech and scar	16(23)	15 (25)
decrease fetal movement	10 (14.7)	10 (16.7)
previous c-section scar	8 (11.7)	12 (20)
FOI	6 (8.8)	8(14)
PV bleed	3 (8.8)	4 (6.7)
Fetal death	5 (14.7)	6 (10)

Table-I. Demographic characteristics and baseline for L3-L4 and L4-L5 groups: (n=94)

Table-I illustrate the basic demographic characteristics of both group, mean age of L3-L4 group was (29.23±3.411) and L4-L5 If we discuss about the co-morbidities, hypertension 29.41% L3-L4 nd 23.33% for L4-L5, type 2 diabetes mellitus 6% in both groups, both HTN and DM in L3- L4 14% and 16% in L4-L5. If we discuss about the number of previous pregnancies, it was assess that 15% female were in with 1st pregnancy, 35% 2nd , 26% in 3rd as in L3-L4 23% in 1st , 36% in 2nd, and 20% in 3rd. and number of previous C-section also assess which shows that 26% were with 1st C-section, 23% in 2nd and 11% in 3rd in L3-L4 and 25% in with 1st, 16% in 2nd and 11% in 3rd. 44% patient were with emergency C-section and 55% with elective for L3-L4 group and for L4-L5 groups group 48% were with emergency and 51% with elective C-section.

If we discuss about the indications of C-section which shows that 11.7% female presented with breech pregnancy, 5.8% with precious pregnancy, 23% with breech and scar, 14% decrease fetal movement, and 14% fetal death in L3-L4 group and in LL4-L5 6% with breech, 8% precious pregnancy, 16% with decrease fetal movement and 10% with fetal death.

Onset of Sensory and Motor Block	L3-L4: n= 60 (n, %)	P-Value	L4-L5: n=60 (n,%)	P-Value
Less than 5 minutes	44 (65)	.434	2(3.4)	.000
Between 5 and 10 minutes	16(35.29)	.010	58(97)	.000
Total duration of sensory block				
Between 2 hour and 2.5 hour	12(17.6)	.009	52(87)	.005
Between 2.5 hour and 3 hour	47(79.4)	.471	8(13.3)	.014
More than 3 hour	1(3)	.141	0(0)	.875
Level of sensory block				
T4	53(79.4)	.003	0(0)	.365
T5	6(17.6)	.485	1(1.7)	.758
T6	0(0)	.569	59(98)	.000
T7	1(3)	.154	0(0)	.145
Intra-operative Hemodynamic				
Hypotension	42(61.7)	.002	1(1.7)	.021
Bradycardia	6(11.7)	.054	0(0)	.121
Stable	12(26.47)	.004	59(98)	.000

Table-II. Spinal Anesthesia presentation for L3-L4 and LL4-L5 roups: (n=94)

Table-II illustrate the spinal anesthesia presentation during and after c-section, which shows that onset of sensory and motor block, 65% patients block their sensation for less than 5 minutes and 35% between 5 and 10 minutes shows no significant

result at p value >0.005 for L3-L4 groups and for L4-L5.4% block their sensation for less than 5 minutes and 97% between 5 and 10 minutes and shows significance at p value <0.05. If we talk about the total duration of sensory block for both groups which shows that 17.6% for between 2 hour and 2.5 hour, 79.4% between 2.5 hour and 3 hour, and only 3% more than 3 hour, it did not show any significant association at p value > 0.05 and for L4-L5 group which shows that 87% between 2 hour and 2.5 hour, 13.3% between 2.5 hour and 3 hour and 0% more than 3 hour and shows significant association at p value <0.05.

Level of sensory block shows that 79.4% patients were at L4, 17.6 T5 and 3% T7 for L3-L4 group and only shows a significant association at L4 with p value <0.05 and for the group of L4- L5, 98% T6 and only 2% T5 with significant association at p value <0.05. We also assess the intra-operative hemodynamic status of both group, which shows that 61.7% develop hypotension, 11.7% bradycardia and only 26.47% patients remain stable for the group of L3-L4 and for the group of L4-L5 only 2% patients develop hypotension and 98% patients remains stable during the procedure and show significant association.

DISCUSSION

This research aimed to investigate the differences in safety and effectiveness od spinal anesthesia given at the L3-L4 and L4-L5 spaces in pregnant women who have undergone a cesarean section. The results from this study suggest that there are some important variations in parameters tested such as sensory block onset, duration of blockade achieved as well as patient's hemodynamic stability anchoring. There were no significant differences in demographics between members of the two groups in terms of age, presence or absence of other diseases or previous pregnancy performance. Most of the cases in both groups were emergencies due to cesarean sections, which are relatively common in clinical practice. It is also worth mentioning that a higher proportion of patients suffered from high blood pressure in the L3-L4 group, which might alter the anesthetic management but did not seem to interfere with the results of the current investigation.

The findings showed that with regard to the onset of sensory block it was found to be significantly quicker in the L3-L4 area where 65% of the people had a sensory block in number of minutes less than five. This rapid onset is consistent with previous studies, such as[13], which also reported quicker onset times for L3-L4 spinal anesthesia. On the contrary, the L4-L5 group was somewhat slower in the onset of sensory block, where only 3.4% of the patients had a sensory block in that range indicated above. This rapid onset at L3-L4 may be helpful in most cases especially emergencies since time is so much of essence.

In terms of the duration of sensory block, the L4-L5 group exhibited a longer duration of effective analgesia, with 87% of patients experiencing a block lasting between 2 and 2.5 hours. This finding is corroborated by[14], who indicated that while L4-L5 may have a slower onset and provides prolonged analgesia, which can significantly enhance postoperative pain management. This longer duration may facilitate better alleviation of pain in the postoperative period, which raises the possible conclusion that the onset of the anesthetic effect may be slower at L4-L5 level, but it may help in controlling pain after surgery. This result is consistent with findings of other research works which suggested that the L4-L5 level could alternative to L3-L4 level esp. as regards extended analgesia.

The depth of anesthesia accomplished differed noticeably between the two groups in terms of sensory block levels. The L3-L4 group had a higher sensory block level (T4) compared to the L4- L5 group whose block level was T6. This observation aligns with literature indicating that higher blocks are often preferred for cesarean deliveries, as noted by.[15] This may be especially pertinent in cases where the surgery may require a higher block sensorially, although this must be weighed against the dangers of complications resulting from having high blocks such as low blood pressure and respiratory difficulties. One of the most important factors for consideration during the administration of spinal anesthesia is hemodynamic stability especially with obstetric

patients. The L3-L4 group had the highest number of patients suffering from hypotension (61.7%). This was contrary in the L4-L5 group where only 2% reported the disorder. This striking odds suggests an advantage in the use of the L4-L5 method which may improve the stability of the patients during the operation. The correlation between the level of sensory block and hemodynamic stability has been documented in other studies, suggesting that lower blocks may mitigate the risk of vasodilation and subsequent hypotension. Numerous studies have documented the correlation between lower sensory blocks and reduced incidence of vasodilation and hypotension.[14] Additionally, a study conducted in Pakistan by Malik et al.[16] further supports our findings, highlighting the lower incidence of hypotension associated with L4-L5 spinal anesthesia in cesarean sections.

To recapitulate, it is evident in this study that the lumbar level selected for spinalization during caesarean section is very significant in the procedure. It is true that the L3-L4 level seems to have a quicker onset but when it comes to the duration of the sensory block and hemodynamic status, the L4-L5 levels are much better. The findings endorse a more advanced approach to the performance of spinal anaesthesia depending on the clinical context and the needs of the patient as to the particular intervertebral space to use.

It is suggested that prolonged follow up studies assess the long-term impact of these observations on mothers and infants. Considering the shifting trends in anesthetic techniques, there will be a need to focus evidence based recommendations in enhancing obstetric perioperative care.

CONCLUSION

This research indicates that there are distinct disparities in the provision of spinal anesthesia between the L3-L4 and L4-L5 vertebrae levels of obstetric patients whom a cesarean section is performed. The results showed that the sensory block using the L3-L4 technique worked faster than the L4-L5 technique. On the other hand, L4-L5 technique lasted longer sensory block and better hemodynamics. Taking this into account, it becomes clear that the level of lumbar for spinal anesthesia is determined with respect to patient and situation factor. This level may also be beneficial in an emergency situation when maintaining hemodynamic stability is necessary.

These findings assist in further informing the evidence base to improve anesthetic care for women undergoing obstetric procedures. This has potential benefits for improving maternal safety, postoperative results and patient experience. It is recommended that other studies are undertaken to support the findings of this research and improve the recommendations for safe spinal anesthesia practice in elective and emergency cesarean sections.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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