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Predictors Of Visceral Pain: An Observational Analysis of Lower Segment Cesarean Section Under Spinal Anesthesia

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ABSTRACT

Background: Despite the adequacy of sensory blockade, a significant proportion of mothers undergoing LSCS experience intraoperative discomfort, particularly visceral pain, necessitating additional analgesia. **Aim:** The study was conducted to assess the predictors of visceral pain of intra-operative period during caesarean section under spinal anesthesia. **Methods:** A profile of 106 parturients who underwent emergency LSCS under spinal anesthesia were included in this prospective observational study. The study included patients classified as American Society of Anaesthesiologists (ASA) Class I and II, aged between 18 and 40years, who were scheduled to undergo lower abdominal surgeries and provided informed consent for spinal anaesthesia. Pain and discomfort during the surgical procedure were evaluated at various stages, including uterine exteriorization, oxytocin administration, and mopping. Pain was assessed on a five-point scale. Pain assessments and intraoperative observations were performed by a blinded investigator. All data were analyzed using statistical software. Continuous variables were presented as mean ± standard deviation. A p-value <0.05 was considered statistically significant. **Results:** Out of 106 patients, 71 (67%) had intraoperative pain, whereas 35 (33%) did not. The results of a proportions Z-test statistical analysis showed a highly significant difference ($p < 0.001$), indicating that patients receiving LSCS under spinal anesthesia frequently experience intraoperative pain. Statistical analysis revealed a p-value of 0.77, indicating no statistically association between fasting status and the occurrence of pain during the procedure. The p-value of 0.34 suggests that there is no statistically significant association between spinal level and the occurrence of chest pain during the procedure. Statistical analysis yielded a p-value of 0.0015, indicating a highly significant association between the level of block and the occurrence of pain. Among the 71 patients who reported experiencing pain, intraoperative events such as mopping, exteriorization of the uterus, and oxytocin administration were having statistically significant correlation topain. Mopping emerged as the most strongly associated factor, with 69 out of 71 patients (97.2%) experiencing pain during this procedure. The exteriorization of the uterus was also a significant factor, with 40 patients (56.3%) reporting pain, potentially due to the stretching and traction exerted on intra-abdominal structures. Similarly, oxytocin administration was associated pain presentin 41 patients (57.7%). **Conclusion:** Intraoperative visceral pain during cesarean delivery is significantly associated with lower sensory block levels and specific surgical maneuvers such as oxytocin administration, uterine exteriorization, and peritoneal mopping. Achieving a higher block level reduced pain incidence, and stopping the provoking stimulus often relieved discomfort. Despite stable hemodynamics, the psychological impact of pain remains a concern. These findings support individualized, non-pharmacologic pain management strategies.

Keywords: Visceral pain, spinal anesthesia, lower segment cesarean section, uterine exteriorization, oxytocin, sensory block.

INTRODUCTION

Lower segment cesarean section (LSCS) is among the most frequently performed obstetric surgeries worldwide, with its prevalence increasing due to various factors, including advancements in medical technology and evolving obstetric practices(1) . The procedure is predominantly performed under regional anesthesia, with spinal anesthesia (SA) being the preferred choice due to its safety, rapid onset, and reliable sensory and motor blockade(2) . Traditionally, lidocaine and

tetracaine were employed, but bupivacaine has become the anesthetic of choice for its prolonged duration of action and better sensory-motor differentiation(3).

Despite the adequacy of sensory blockade, a significant proportion of mothers undergoing LSCS experience intraoperative discomfort, particularly visceral pain, necessitating additional analgesia(3). This discomfort is most commonly reported during uterine exteriorization and traction on abdominal viscera, which stimulates visceral afferent nerves(4). Additionally, oxytocin, a vital drug administered post-delivery to promote uterine contraction and prevent atonic postpartum hemorrhage, has been associated with adverse effects, including epigastric pain, nausea, and flushing(5) . Epigastric pain during LSCS under spinal anesthesia is a recognized side effect of oxytocin bolus administration, complicating intraoperative management (5).

Visceral pain is dull, poorly localized and appears to emanate from deep sites of the body. If visceral sensations remain, they may be described as heaviness, squeezing or an unpleasant feeling, which is often accompanied by nausea and vomiting(6).Visceral pain is thought to be conducted via unmyelinated C fibers. It was hypothesized that as the concentration of local anesthetic in the cerebrospinal fluid decreases, these C fibers may regain function, even though the myelinated A-delta fibers responsible for transmitting incisional pain remain blocked(6).Visceral pain during LSCS may arises primarily from surgical manipulation, such as uterine traction and peritoneal irritation, which activate visceral nociceptors . An inadequate or uneven distribution of local anesthetics can leave visceral nerves partially blocked, leading to incomplete block.

Several patient- and procedure-related factors influence the incidence and severity of visceral pain. Younger age, higher body mass index (BMI), prolonged surgical duration, and the technique of uterine exteriorization have been identified as potential predictors(7). Additionally, hormonal changes and psychological factors during pregnancy may also play a role in pain perception(7).

Understanding the multifactorial nature of visceral pain during LSCS under spinal anesthesia is crucial for optimizing pain management strategies. By investigating the predictors of this pain, this study aims to enhance the quality of care and overall satisfaction of mothers undergoing LSCS .

MATERIALS AND METHODS

A prospective observational study was conducted in the Department of Anesthesia and Critical Care, LD Hospital, GMC Srinagar, over a four-month period from September 1, 2023, to December 31, 2023. A total of 106 parturients, aged 26–39 years, scheduled for elective lower segment cesarean section (LSCS) under spinal anesthesia (SA), were enrolled after obtaining informed written consent. The study received approval from the Institutional Ethics Committee. The study included patients classified as American Society of Anaesthesiologists (ASA) Class I and II, aged between 18 and 40years, who were scheduled to undergo lower abdominal surgeries and provided informed consent for spinal anaesthesia. Patients were excluded if they were classified as ASA Class III or above, were aged below 18 or above 40 years, had a known allergy to any of the drugs used in the study, or presented with conditions such as heart block, dysrhythmias, heart failure, or bradycardia. Additionally, patients who refused to participate were also excluded from the study.

On arrival in the operating room, an 18G intravenous (IV) cannula was inserted, and patients were coloaded with 20ml/kg of lactated Ringer's solution. Standard monitoring, including electrocardiogram (ECG), non-invasive blood pressure (NIBP), and pulse oximetry (SpO_2), was applied, and baseline heart rate (HR), mean arterial pressure (MAP), and SpO_2 were recorded.

Spinal anesthesia was administered in the sitting position under sterile conditions at the L2-L3 or L3–L4 interspace using a 25G Quincke spinal needle. The bevel of the needle was oriented parallel to the dural fibers and rotated cephalad upon insertion. Hyperbaric bupivacaine 0.5% 15 mg was injected intrathecally, and the correct needle position was confirmed by the free flow of cerebrospinal fluid (CSF) before injection. Patients were immediately placed supine with a left lateral uterine tilt using a wedge to prevent aortocaval compression. Sensory blockade was confirmed bilaterally to a pinprick test before initiating surgery.

Intraoperative monitoring of HR, MAP, and SpO2 was performed continuously, with MAP measured at 1-minute intervals for the first 5 minutes, followed by 7 and 10-minute measurements. Mean blood pressure was maintained within 20% of baseline values using bolus doses of mephentermine (15 mg) in incremental doses or phenylephrine (50 µg), as and when required.

Following the clamping of the umbilical cord, oxytocin was administered as a bolus dose of 5µg followed by an infusion of 20 units in 1 pint of ringer lactate (RL) at 150 ml/hr. Uterine tone was assessed by the obstetrician and categorized as adequate or inadequate. An additional bolus of 5 IU oxytocin was administered if requested by the obstetrician in cases of inadequate uterine contraction.

Pain and discomfort during the surgical procedure were evaluated at various stages, including uterine exteriorization, oxytocin administration, and mopping. Pain was assessed on a five-point scale:
- Excellent: No complaints.
- Mild: Discomfort requiring no additional analgesia.
- Moderate: Discomfort associated with nausea.
- Severe: Pain requiring fentanyl.
- Failed: Conversion to general anesthesia.

To ensure uniformity, spinal anesthesia was performed by a single anesthetist who was not involved in data collection. Pain assessments and intraoperative observations were performed by a blinded investigator. All data were analyzed using statistical software. Continuous variables were presented as mean ± standard deviation. A p-value <0.05 was considered statistically significant.

RESULTS

The study included 106 parturients who underwent emergency LSCS under spinal anesthesia. The observations made during the study are summarized below:

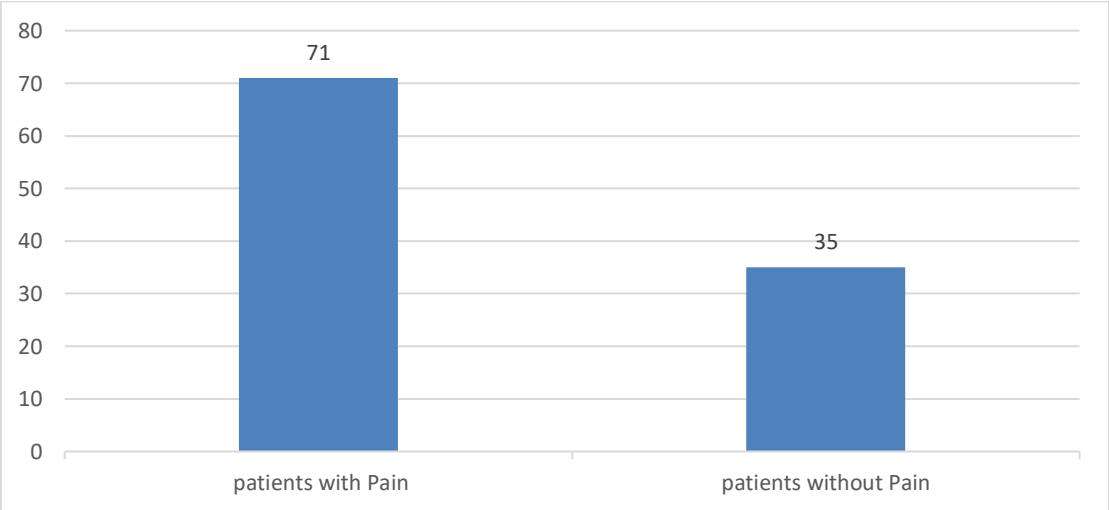
The mean age of the participants was 25.9 years (range: 21–34 years). Most of the participants belonged to the ASA Grade II category, indicating a relatively low risk for surgical complications.

Table 1: Demographic Profile of Parturients

PARAMETER	MEAN ± SD	RANGE
AGE (YEARS)	25.93 ± 3.28	21–34
WEIGHT (KG)	65.2 ± 7.8	52–78
ASA GRADE I	32 (29.9%)	--
ASA GRADE II	75 (70.1%)	--

Table 2: Incidence Of Pain Among Parturients

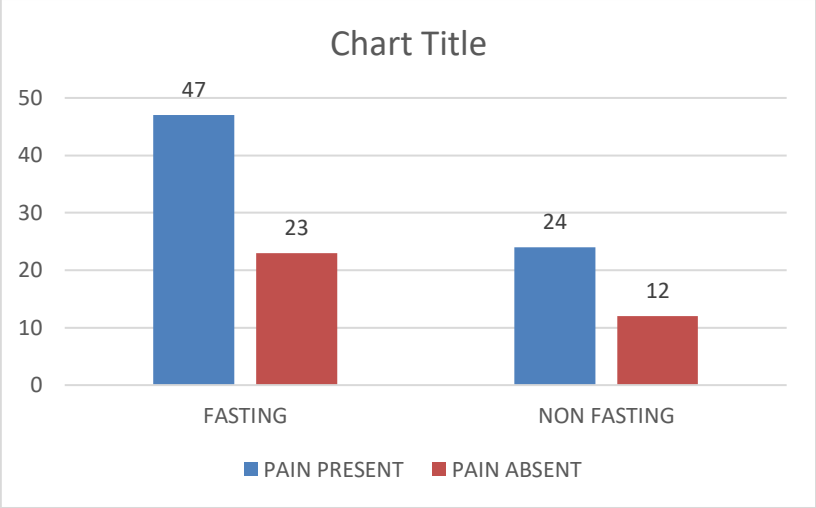
NUMBER OF PATIENTS	PAIN
71	YES
35	NO



Of the 106 patients in our study, 71 (67%) had intraoperative pain, whereas 35 (33%) did not. The results of a proportions Z-test statistical analysis showed a highly significant difference ($p < 0.001$), indicating that patients receiving LSCS under spinal anesthesia frequently experience intraoperative pain.

Table 3: Association Between Pain And Fasting Status .

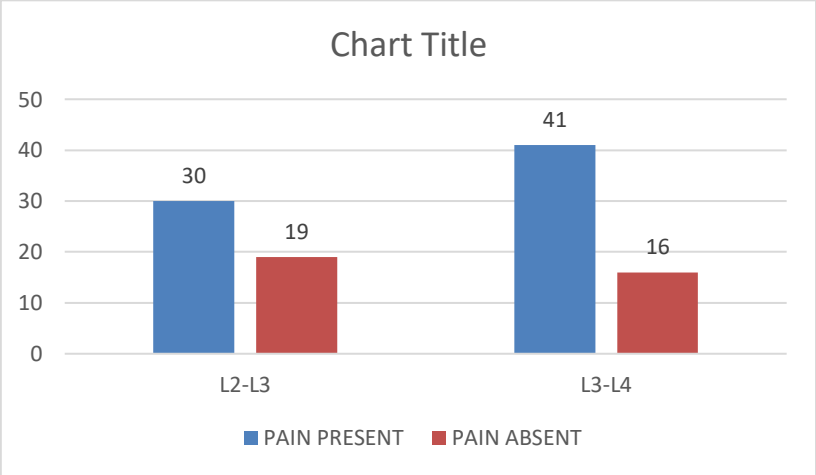
PAIN STATUS	NON FASTING	FASTING	TOTAL
PAIN PRESENT	24(33.8%)	47(66.2%)	71(67%)
PAIN ABSENT	12(34.3%)	23(65.7%)	35(33%)
TOTAL	36(34%)	70(66%)	106(100%)



Among the 106 patients, 36 (34.0%) were non-fasting and 70 (66.0%) were fasting. Pain was reported in 71 patients (67.0 %), of which 24 (33.8%) were non-fasting and 47 (66.2%) were fasting. Among the 35 (33.0%) patients without pain, 12 (34.3%) were non-fasting and 23 (65.7%) were fasting patients. Statistical analysis revealed a p-value of 0.77, indicating **no statistically association** between fasting status and the occurrence of pain during the procedure.

Table 4: Association Between Pain And Level Of Needle Insertion.

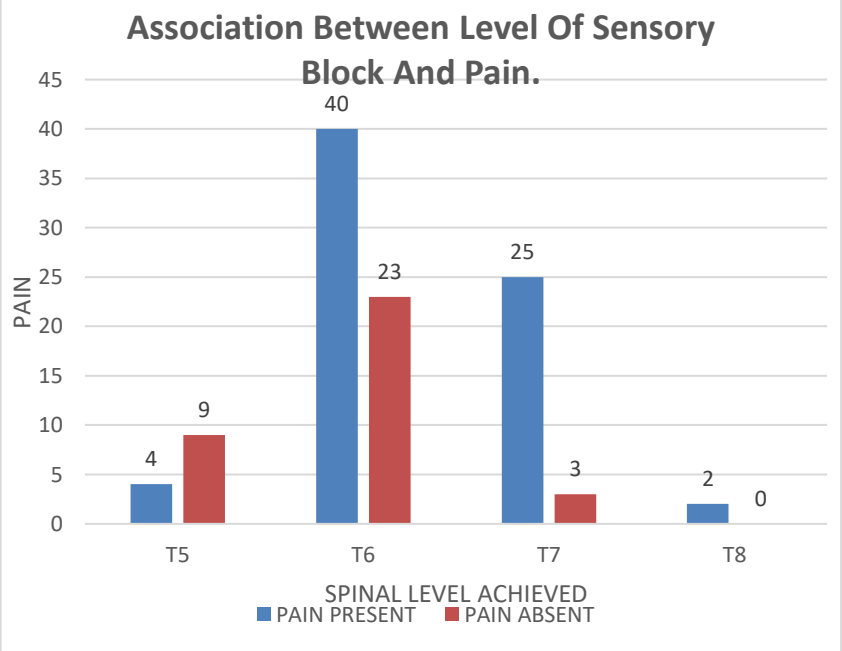
LEVEL OF NEEDLE INSERTION	PAIN ABSENT	PAIN PRESENT	TOTAL
L2,3	19(38.8%)	30(61.2%)	49(46.2%)
L3,4	16(28.1%)	41(71.9%)	57(53.8%)
TOTAL	35(33.0%)	71(67%)	106(100%)



Among the 106 patients, 49 received spinal anesthesia at the L2-3 level, while 57 received it at the L3-4 level. Pain was reported in 71 patients, with 30 (61.2%) occurring at the L2-3 level and 41 at the L3-4 level. Among the 35 patients pain absent, 19 had received at the L2-3 spinal level, and 16 had received at the L3-4 spinal level. The p-value of 0.34 suggests that there is **no statistically significant association** between spinal level and the occurrence of chest pain during the procedure.

Table 5: Association Between Level Of Sensory Block And Pain.

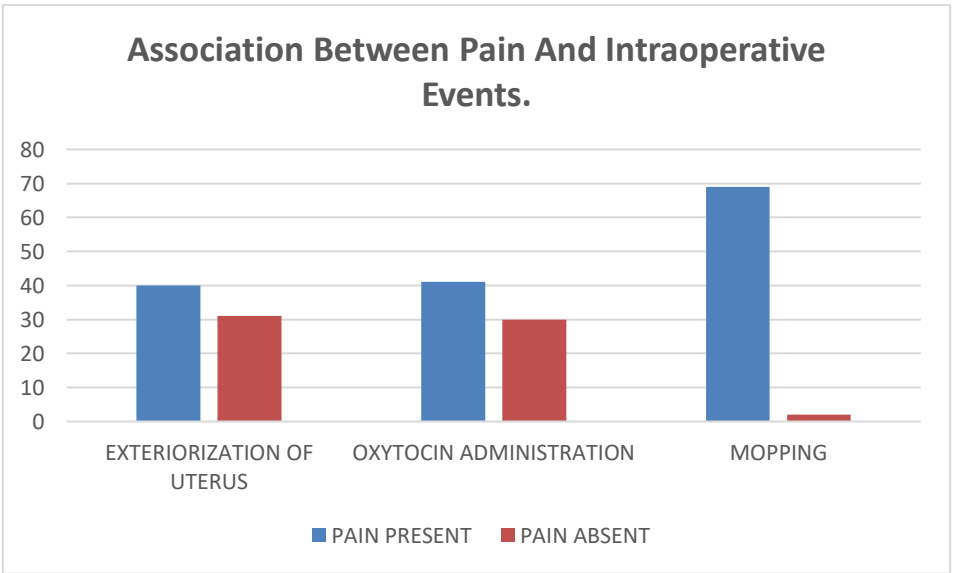
LEVEL OF BLOCK	PAIN ABSENT	PAIN PRESENT	TOTAL
T5	9(69.2%)	4(30.8%)	13(12.3%)
T6	23(36.5%)	40(63.5%)	63(59.4%)
T7	3(10.7%)	25(89.3%)	28(26.4%)
T8	0	2(100%)	2(1.9%)
TOTAL	35(33%)	71(67%)	106(100%)



Among 106 patients, 13 (12.3%) had a block level at T5, 63 (59.4%) at T6, 28 (26.4%) at T7, and 2 (1.9%) at T8. The incidence of pain varies significantly across these levels. Patients with a higher block level, such as T5, reported the lowest incidence of pain, with only 4 out of 13 (30.8%) experiencing discomfort. In contrast, those with a T6 block level had a higher incidence, with 40 out of 63 (63.5%) patients reporting pain. The frequency of pain further increased at T7, where 25 out of 28 (89.3%) patients experienced discomfort. Notably, all 2 patients (100%) who had a block level at T8 reported pain. Conversely, among the 35 (33.0%) patients who did not experience chest pain, the majority had a higher block level, with 9 out of 13 (69.2%) at T5, 23 out of 63 (36.5%) at T6, and only 3 out of 28 (10.7%) at T7. None of the patients who received a block at the T8 level remained pain-free. Statistical analysis yielded a p-value of 0.0015, indicating a **highly significant association between the level of block and the occurrence of pain.**

Table 6: Association Between Pain And Intraoperative Events.

INTRAOPERATIVE EVENTS	PAIN PRESENT	PAIN ABSENT	P value
EXTERIORIZATION OF UTERUS	40(56.3%)	31(43.7%)	0.646
OXYTOCIN ADMINISTRATION	41(57.7%)	30(42.3%)	0.418
MOPPING	69(97.2%)	2(2.8%)	$2.57*10^{-26}$

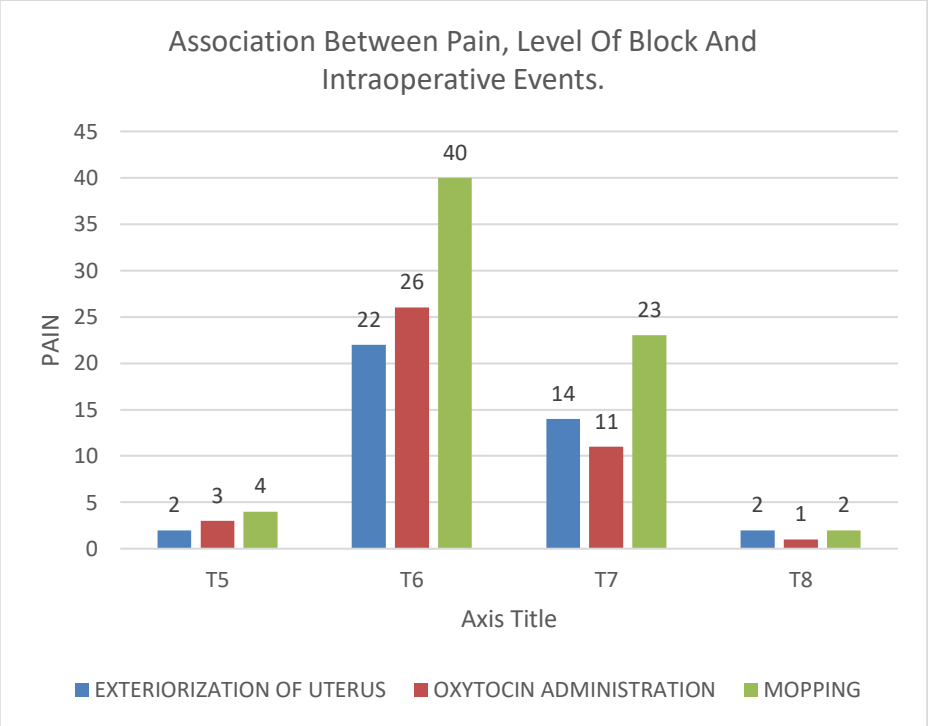


Among the 71 patients who reported experiencing pain, intraoperative events such as mopping, exteriorization of the uterus, and oxytocin administration were having statistically significant correlation topain. Mopping emerged as the most strongly associated factor, with 69 out of 71 patients (97.2%) experiencing pain during this procedure. The

exteriorization of the uterus was also a significant factor, with 40 patients (56.3%) reporting pain, potentially due to the stretching and traction exerted on intra-abdominal structures. Similarly, oxytocin administration was associated pain presentin 41 patients (57.7%).

Table 7: Association Between Pain, Level Of Block And Intraoperative Events.

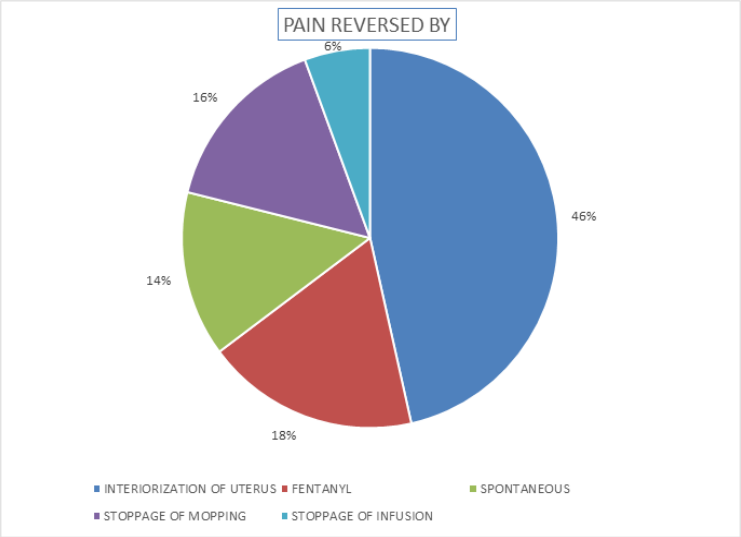
LEVEL OF BLOCK	EXTERIORIZATION OF UTERUS	OXYTOCIN ADMINISTRATION	MOPPING	PAIN PRESENT	TOTAL PATIENTS
T5	2(50%)	3(75%)	4(100%)	4(30.8%)	13
T6	22(55%)	26(65%)	40(100%)	40(63.5%)	63
T7	14(56%)	11(44%)	23(92%)	25(89.3%)	28
T8	2(100%)	1(50%)	2(100)	2(100%)	2



The analysis of 71 patients who experienced intraoperative pain identified mopping as the most frequently reported cause, with 100% of patients at the T5, T6, and T8 levels, and 92% at T7, experiencing discomfort due to this stimulus. Pain following oxytocin administration was also a prevalent factor, affecting 75% of patients at T5, 65% at T6, 44% at T7, and 50% at T8, indicating some variation across different spinal levels. Similarly, pain during exteriorization of the uterus was reported in 50% of patients at T5, 55% at T6, 56% at T7, and 100% at T8. Despite these variations, statistical analysis using the Chi-square test yielded a p-value of 0.965, indicating **no significant association** between the level of sensory block and the specific cause of pain.

Table 8: Association Between Pain and Pain Reversal Methods.

REVERSED BY	NUMBER OF PATIENTS
INTERIORIZATION OF UTERUS	33
FENTANYL	13
SPONTANEOUS	10
STOPPAGE OF MOPPING	11
STOPPAGE OF INFUSION	4
TOTAL	71



Among the 71 patients who reported pain, various methods were used to reverse discomfort. The most commonly employed technique was the Interiorization of the Uterus, which accounted for 33 cases (46.5%), making it the predominant method. Fentanyl was the second most frequently used approach and was administered to 13 patients (18.3%). 10 patients (14.1%) experienced spontaneous pain resolution, without any specific intervention. Stopping mopping was another method used in 11 cases (15.5%), while stoppage of infusion was the least common method, observed in 4 cases (5.6%) which were **statistically significant.**

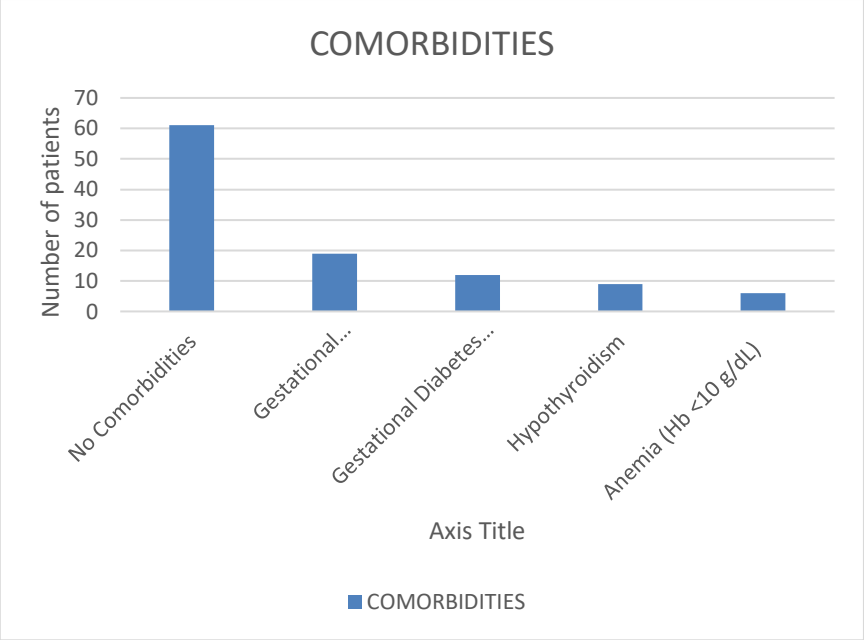
Table 9: Hemodynamic Stability During LSCS

Time (Minutes)	Baseline MAP (mmHg)	Mean MAP (mmHg)	Heart Rate (bpm)
1 Minute	91.2 ± 8.1	88.8 ± 7.5	95.9 ± 8.7
5 Minutes	92.0 ± 8.0	89.6 ± 6.5	95.1 ± 9.2
10 Minutes	92.8± 8.3	90.5 ± 7.3	94.3 ± 8.9

Mean arterial pressure (MAP) and heart rate were monitored at specific time points to assess hemodynamic stability. Most patients maintained stable parameters with minimal interventions.

Table 10: Comorbidities Among Study Participants

Comorbidity	Number of Patients (n)	Percentage (%)
No Comorbidities	61	57.0%
Gestational Hypertension (GH)	19	17.8%
Gestational Diabetes Mellitus (GDM)	12	11.2%
Hypothyroidism	9	8.4%
Anemia (Hb <10 g/dL)	6	5.6%



A detailed analysis of comorbid conditions among parturients revealed that gestational hypertension (GH) was the most common comorbidity, followed by gestational diabetes mellitus (GDM). A small percentage of patients had hypothyroidism or anemia. These conditions were appropriately managed to ensure optimal surgical outcome. Of the 107 parturients, 46(43.0%) had at least one comorbid condition. Gestational hypertension was the most prevalent condition, observed in 17.8% of the participants, followed by gestational diabetes mellitus (11.2 %) and hypothyroidism (8.4 %). Only 5.6% of participants had anemia, reflecting a well-maintained antenatal care program. Most participants (57.0%) had no significant comorbidities, indicating a relatively healthy population in this cohort.

DISCUSSION

Neuraxial anesthesia has been and remains the gold standard anesthetic method for cesarean delivery(8).It is generally accepted that sensory analgesia to at least the fourth thoracic dermatome is necessary for Caesarean section.However, even with this level of sensory analgesia, many mothers complain of un-pleasant feelings intraoperatively(6). The Obstetric Anaesthetists' Association has previously noted that intraoperative pain may occur in approximately 5% of cesarean deliveries under spinal anesthesia(9).In our study we used 15 mg of hyperbaric Bupivacaine for spinal anaesthesia via a 25G Quinkes spinal needle in sitting postion,as per standard protocol. We used L3,4 and L4,5 intervertebral space for needle insertion. we observed a statistically significant association between block level and visceral pain incidence ($p = 0.0015$). Visceral pain was less common at higher block levels30.8% at T5 and 63.5% at T6compared to 89.3% at T7 and 100% at T8 suggesting that level of block achieved directly corresponds to the incidence of visceral pain.Visceral pain was most frequently associated with intraoperative events such as oxytocin administration, mopping and uterine exteriorization.

Oxytocin, a uterotonic agent, is the mainstay of treatment for uterine atony. Rapid injection of oxytocin produces various adverse effects, which include tachycardia, hypotension, ST depression in ECG, nausea, vomiting, headache and flushing(5). Epigastric pain is also an established side effect of oxytocin(5).In our study ,Oxytocin administration was also found to be associated with pain in 57.7% of patients reporting intraoperative discomfort which was in line with the study conducted by Kashif et al. In a few cases, stopping the infusion led to resolution of the pain. This finding supports the importance of careful titration and monitoring of oxytocin during cesarean delivery.

Uterine exteriorization was a prominent predictor of visceral pain in this study, reported by 56.3% of patients who experienced intraoperative discomfort which is widely recognised(6). The traction and manipulation of the uterus and peritoneum likely stimulates visceral afferent fibers, which may not be fully anesthetized by spinal blockadecontributing to the pain experienced. Moreover , interiorization of the uterus reversed pain in 46.5% of cases, suggesting a direct relationship between uterine manipulation and visceral pain which was in consistence with study by EL khayat W et al(4).

A statistically significant number of patients who reported Mopping, or peritoneal cleaning, as the most pain-provoking stimulus.The peritoneum is richly innervated, and mechanical stimulation during mopping may elicit visceral pain that spinal anesthesia does not completely suppress. Despite achieving an apparently adequate sensory level, the persistence of pain suggests an incomplete block of visceral afferents. In 15.5% of cases, stopping mopping reversed the pain, further implicating this maneuver as a significant contributor.

Needle insertion level (L2–L3 vs. L3–L4) was not significantly associated with intraoperative pain ($p = 0.34$), nor was fasting status ($p = 0.77$). These findings suggest that correct technique and adequate sensory block are more critical than insertion level or fasting status in influencing intraoperative pain.

These observations support an individualized approach to managing intraoperative discomfort, emphasizing identification and reversal of the triggering stimulus before pharmacologic intervention. The routine use of systemic analgesics such as fentanyl should be balanced against their potential side effects, particularly in awake parturients. Multimodal strategies incorporating non-opioid analgesics may be more appropriate in selected cases. Prioritizing non-pharmacologic interventions, such as halting the provoking maneuver, can optimize maternal comfort while maintaining safety.

Hemodynamic parameters remained largely stable throughout our study, suggesting that pain perception was not influenced by systemic instability. Mean arterial pressure and heart rate showed minimal variation, reinforcing the overall hemodynamic safety of spinal anesthesia in this setting. Nonetheless,. Intraoperative pain has been associated with increased risk of postpartum depression and post-traumatic stress disorder, emphasizing the importance of effective pain management strategies(10).

The primary limitation of this study is its observational nature. Further randomized controlled trials are needed to evaluate the efficacy of tailored intraoperative pain management strategies during LSCS. Future research should also explore the long-term psychological and physical consequences of inadequately controlled intraoperative visceral pain.

CONCLUSION

Our study found that intraoperative visceral pain during cesarean delivery is significantly associated with lower sensory block levels and specific surgical maneuvers such as oxytocin administration, uterine exteriorization, and peritoneal mopping. Achieving a higher block level reduced pain incidence, and stopping the provoking stimulus often relieved discomfort. Despite stable hemodynamics, the psychological impact of pain remains a concern. These findings support individualized, non-pharmacologic pain management strategies.

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