ORIGINAL RESEARCH

To study the effectiveness of adding dexmedetomidine versus fentanyl to intrathecal 0.5% levobupivacaine on spinal block in LSCS, in a tertiary care center

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ABSTRACT

Aim: The aim of the present study is to determine the effect of adding dexmedetomidine and fentanyl to levobupivacaine in subarachnoid block for LSCS on the outcome of the patient. **Methods:** This is a comparative study which is carried out in the Department of Anesthesiology for duration of six months, which included 150 patients as study participants. Patients were divided into three equal groups. Group I, Group II and Group III. Patients' detailed demographics were recorded after taking verbal and written consent. **Results:** The mean age of the patients in group I was 28.42 ± 6.54 years with BMI 23.17±8.32, mean age in group II was 27.33 ±7.53 years with BMI 24.46 ± 6.14 and in group III mean age was 26.94 ±9.51 years with BMI 24.76 ±4.36. Patents arterial pressure and heart beat per minute recorded. In Group III and II (5.15±2.38 min, 6.04±5.16 min), the maximum in Group I (8.02± 2.18 min) time needed for the highest level of sensory block was the shortest gap between three categories ($p < 0.001$). Bromage Scale 3 was averaged in a similar way, less in Group III (2.88 ±1.52) and statistically significant across the three groups ($p < 0.001$). The time needed for sensory regression to level S1 (sensory block duration) in Group II was maximum (501.05 ± 14.38 min) and high between groups of three ($p< 003$). The time gap needed in Group II (403.37 ±10.05 min) and Group I (300.06±4.46 min) for the first analgesic requirement was highly important ($p < 0.001$) and the most significant. Frequency of side effects (Hypotension, Nausea/Vomiting, Respiratory depression) Shivering were also observed between the patients of these three groups. **Conclusion:** We observed and concluded that for an adjuvant of 0.5percent isobaric levobupivacaine, Intrathecal dexmedetomidine induces both prolonged motor blockage and post operative analgesia than fentanyl.

Key words: Levobupivacaine, spinal anesthesia, fentanyl, intrathecal analgesia, cesarean section, dexmedetomidine

INTRODUCTION

Spinal anesthetic is a highly effective method for managing pain after ambulatory procedures [1]. However, it can lead to a longer recovery time for motor function and delayed ability to walk, which in turn might result in a longer hospital stay [2, 3]. The utilization of low-dose spinal technique, which incorporates the administration of small amounts of local anesthetics along with fentanyl, has enhanced the effectiveness of spinal anesthesia in ambulatory surgical settings. This technique allows for heightened sensory response without causing an increase in motor block or delaying the time required for urination. However, the primary issues with this approach continue to be insufficient anesthetic and the potential dangers associated with intrathecal opioids [4, 5]. Intrathecal α2-adrenoceptor agonists, when used as adjuvant medicines, have demonstrated the ability to reduce the necessary amounts of local anesthetics [6, 7]. Dexmedetomidine is an α2-adrenoceptor agonist with

good selectivity. It enhances the effects of local anesthetics, extends the duration of pain relief after surgery, and has a calming effect that depends on the dosage, without causing respiratory depression [8]. The precise mechanism by which intrathecal α2-adrenoceptor agonists work is not fully understood. However, it is believed that they may enhance the effects of local anesthetics by binding to the pre-synaptic C-fibers and postsynaptic dorsal horn neurons. This binding leads to analgesia by reducing the release of C-fiber neurotransmitters and hyperpolarizing the postsynaptic dorsal horn cells [9, 10]. The extension of motor block caused by spinal anesthetics may be due to the hyperpolarization of ventral horn motoneurons in the spinal cord, which enhances the effect of the local anesthetic [11].

Fentanyl is the predominant short-acting opioid that is commonly administered intrathecally in conjunction with local anesthetics. It exhibits synergistic effects when used in combination with local anesthetics and enhances the quality of pain relief during and after surgery [12]. According to reports, administering fentanyl through the intrathecal route at a dosage of 10-25 micrograms can extend the duration of surgical pain relief for around 180-240 minutes [13]. Nevertheless, intrathecal opioids may induce some adverse effects like pruritus, urine retention, emesis, and respiratory depression [14, 15].

The objective of this study was to assess the effect of incorporating dexmedetomidine and fentanyl into levobupivacaine during subarachnoid block for LSCS on patient outcomes.

MATERIALS AND METHODS

The current study is a hospital based observational comparative study carried out in the Department of Anesthesiology for duration of six months with 150 patients. Patients were divided into three equal groups Group I, Group II and Group III. Patient's detailed demographics were recorded after taking written consent. Patients who had eclampsia, pre-eclampsia, diabetes and those who did not give any written consent were excluded from this study.

Group I had 50 patients and received 2.5 ml isobaric levobupivacaine, group II with 50 patients and received 2.5 ml isobaric levobupivacaine and 5µg dexmedetomidine, and group III received 2.5 ml isobaric levobupivacaine and 25µg fentanyl respectively. The anesthesiologist who engaged in drug preparations carried out randomization. The group allocation was not identified to another investigator who was interested in process and supervision. The drug regimen used in spinal anesthesia was also blinded to the patients.

A comparison of block characteristics and duration of postoperative analgesia were the primary findings. Secondary findings were compared with hemodynamic parameters, rescuer analgesia and adverse effects of intra-thecal dexmedetomidine or fentanyl with isobaric levobupivacaine of 0.5 percent. The sensory block level measured bilaterally in the midclavicular line, the hypodermic needle and dermatic levels were checked every 2 minutes with a lack of fine prick sensations, before successive tests were carried out at the highest level. The highest degree of sensory blockade, the period from injection to S1, was reported from the time of sensory regression. Using the Chi-square test, nominal categorical data was compared. The full SPSS 26.0 version analysed the results. The p value <0.05 was found with a statistically significant difference.

RESULTS

Table 1: Baseline details of the study participants

Variables	Group I(n=50)	Group II(n=50)	Group III(n=50)
Mean Age (Yrs)	28.42 ± 6.54	27.33 ±7.53	26.94 ±9.51
BMI	23.17±8.32	24.46 ± 6.14	24.76 ±4.36
HR (beats/min)	84.04 ± 7.63	85.55 ± 6.54	85.85 ± 4.56
MAP (mmHg)	97.07 ±3.14	95.45 ±4.76	96.14 ±5.35

The mean age of the patients in group I was 28.42 ± 6.54 years with BMI 23.17±8.32, mean age in group II was 27.33 ±7.53 years with BMI 24.46 ± 6.14 and in group III mean age was 26.94 ±9.51 years with BMI 24.76 ±4.36. Patients arterial pressure and heart beat per minute recorded.

Table 2: Comparison of block characteristics by the first analgesic needs of the groups

Variables	Group I(n=50)	Group II(n=50)	Group III(n=50)	P value
Sensory Block (mean time)	8.02± 2.18	5.15±2.38	6.04±5.16	<0.001
Bromage 3 (mean time)	4.86 ± 1.58	3.81 ± 1.45	2.88 ±1.52	<0.001
S1 level sensory regression (mean time)	285.15 ± 16.34	501.05 ± 14.38	416.04 ± 18.42	<0.001
first analgesic (mean time)	300.06±4.46	403.37 ±10.05	344.26 ± 12.28	<0.001

In Group III and II (5.15±2.38 min, 6.04±5.16 min), the maximum in Group I (8.02± 2.18 min) time needed for the highest level of sensory block was the shortest gap between three categories ($p < 0.001$). Bromage Scale 3 was averaged in a similar way, less in Group III (2.88 ±1.52) and statistically significant across the three groups ($p < 0.001$). The time needed for sensory regression to level S1 (sensory block

duration) in Group II was maximum (501.05 ± 14.38 min) and high between groups of three (p< 003). The time gap needed in Group II (403.37 ±10.05 min) and Group I (300.06±4.46 min) for the first analgesic requirement was highly important (p < 0.001) and the most significant.

Table 3: Frequency of side effects among the study groups

Variables	Group I	Group II	Group III	P value
Nausea/Vomiting	3	4	6	0.75
Shivering	5	0	4	0.44
Hypotension	7	6	6	0.92
Respiratory depression	0	0	3	0.12

Frequency of side effects (Hypotension, Nausea/Vomiting, Respiratory depression) Shivering were also observed between the patients of these three groups.

DISCUSSION

Spinal anesthesia induces a profound sensory blockade, while also minimizing adverse effects on both the mother and the fetus. Cesarean sections remain the favored approach for executing the procedure [16, 17]. Although this method has several benefits, it has a limited duration and cannot provide sufficient postoperative pain relief. Optimal postoperative analgesia is crucial following a cesarean delivery since it facilitates more efficient nursing and infant care. Various drugs, such as opioids, magnesium sulfate, vasopressors, and 2-adrenergic agonists (dexmedetomidine and clonidine), have been extensively tested as additional treatments to local anesthetics in recent years. These drugs seem to offer benefits not only in controlling pain after surgery but also in improving patient satisfaction with the procedure.[17-19] The most often used short-acting opioid in the United States is a mixture of fentanyl and local anesthetics, which is delivered intrathecally. When used with local anesthetics, it exhibits synergistic effects that enhance both intraoperative and postoperative pain relief [17]. Studies have shown that when fentanyl is delivered intrathecally at a dosage of 10-25 micrograms, it can greatly prolong the duration of postoperative pain relief by around 180-240 minutes compared to intravenous administration.

Currently, there is significant interest in using intrathecal injection of Dexmedetomidine to prolong the duration of analgesia and reduce postoperative discomfort in spinal anesthesia. Several studies have investigated the use of various dosages of intrathecal Dex (3µg, 5µg, 10µg, 15µg) alongside local anesthetics [20-23]. Dexmedetomidine appears to stimulate the activation of α2-agonist receptors in the spinal cord, resulting in a reduction in the transmission of pain signals, such as substance P. Furthermore, it has been disclosed that the analgesic effects of the treatment following the surgery are a result of the suppression of intracellular potassium transport activities [24].

The average age of patients in group I was 28.42 ±6.54 years, with a body mass index (BMI) of 23.17 ± 8.32. In group II, the average age was 27.33 ± 7.53 years, with a BMI of 24.46 ± 6.14. In group III, the average age was 26.94 ± 9.51 years, with a BMI of 24.76 ± 4.36. Arterial pressure and heart rate were measured and recorded. The lowest duration of time required to achieve the highest level of sensory block was observed in Group I (8.02±2.18 min), while Groups III and II had longer durations (5.15±2.38 min, 6.04±5.16 min) respectively. This difference between the three groups was statistically significant (p < 0.001). This was similar to the research undertaken by Joginder Pal *et al*. [25] The Bromage Scale 3 was calculated in a similar manner, with a slightly lower average in Group III (2.88 ±1.52), and the difference was statistically significant across all three groups (p < 0.001). The duration of sensory regression to level S1 (sensory block duration) in Group II was at its maximum (501.05 ± 14.38 min) and significantly higher compared to the other three groups (p< 003). The time interval required for the initial analgesic demand was significantly different between Group II (403.37 ±10.05 min) and Group I (300.06±4.46 min), with a high level of significance (p < 0.001). This difference was the most significant among all the observed variables. Our research demonstrated similarities to other prior studies, indicating that the inclusion of Intrathecal dexmedetomidine in isobaric levobupivacaine yielded superior outcomes compared to fentanyl [25, 26]. The frequency of adverse symptoms, namely hypotension, nausea/vomiting and respiratory depression. Tremors were also found among the patients in these three groups. The most prevalent problem observed in all three groups was hypotension, followed by nausea/vomiting, shivering, and respiratory depression. These results were similar to the earlier findings [27].

CONCLUSION

Based on our observations and the study findings, we came to the conclusion that intrathecal dexmedetomidine generates both sustained motor blockage and post-operative analgesia more effectively than fentanyl does when used as an adjuvant with 0.5 percent isobaric levobupivacaine.

CONFLICT OF INTEREST: None to be declared.

REFERENCES

1. Liu SS, Strodtbeck WM, Richman JM, Wu CL. A comparison of regional versus general anesthesia for ambulatory anesthesia: a meta-analysis of randomized controlled trials. Anesth Analg. 2005 Dec;101(6):1634-1642.
2. Chung F, Mezei G. Factors contributing to a prolonged stay after ambulatory surgery. Anesth Analg. 1999 Dec;89(6):1352-9.
3. Philip BK. Patients' assessment of ambulatory anesthesia and surgery. Journal of clinical anesthesia. 1992 Sep 1;4(5):355-8.
4. Ben-David B, Solomon E, Levin H, Admoni H, Goldik Z. Intrathecal fentanyl with small-dose dilute bupivacaine: better anesthesia without prolonging recovery. Anesthesia & Analgesia. 1997 Sep 1;85(3):560-5.
5. Liu S, Chiu AA, Carpenter RL, Mulroy MF, Allen HW, Neal JM, Pollock JE. Fentanyl prolongs lidocaine spinal anesthesia without prolonging recovery. Anesth Analg. 1995 Apr;80(4):730-4.
6. Dobrydnjov I, Axelsson K, Thörn SE, Matthiesen P, Klockhoff H, Holmström B, Gupta A. Clonidine combined with small-dose bupivacaine during spinal anesthesia for inguinal herniorrhaphy: a randomized double-blinded study. Anesth Analg. 2003 May;96(5):1496-1503.
7. De Kock M, Gautier P, Fanard L, Hody JL, Lavand'homme P. Intrathecal ropivacaine and clonidine for ambulatory knee arthroscopy: a dose-response study. Anesthesiology. 2001 Apr;94(4):574-8.
8. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM, Ammari BA, Awwad ZM, Al-Edwan GM, Ramsay MA. Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. Saudi Med J. 2009 Mar;30(3):365-70.
9. Eisenach JC, De Kock M, Klimscha W. α2-Adrenergic agonists for regional anesthesia: a clinical review of clonidine (1984-1995). The Journal of the American Society of Anesthesiologists. 1996 Sep 1;85(3):655-74.
10. Fairbanks CA, Wilcox GL. Spinal antinociceptive synergism between morphine and clonidine persists in mice made acutely or chronically tolerant to morphine. Journal of Pharmacology and Experimental Therapeutics. 1999 Mar 1;288(3):1107-16.
11. Smith C, Birnbaum G, Carter JL, Greenstein J, Lublin FD. Tizanidine treatment of spasticity caused by multiple sclerosis: results of a double-blind, placebo-controlled trial. US Tizanidine Study Group. Neurology. 1994 Nov 1;44(11 Suppl 9):S34-42.
12. Jain N, Mathur PR, Soni P, Patodi V, Sethi SK, Mathur V. A comparative clinical study of intrathecal bupivacaine 2.5 mg with dexmedetomidine 5µg versus intrathecal bupivacaine 2.5 mg with fentanyl 25µg on the duration of labor analgesia using combined spinal epidural technique. J Obstet Anaesth Crit Care. 2019;9(1):24-29.
13. Dahl JB, Jeppesen IS, Jorgensen H, Wetterslev J, Moiniche S. Intraoperative and postoperative analgesic efficacy and adverse effects of intrathecal opioids in patients undergoing cesarean section with spinal anesthesia: a qualitative and quantitative systematic review of randomized controlled trials. Anesthesiol J Am Soc Anesthesiol. 1999;91(6):1919-1927.
14. Jarineshin H, Fekrat F, Kermanshah AK. Treatment of postoperative pain in pediatric operations: comparing the efficiency of bupivacaine, bupivacaine-dexmedetomidine and bupivacaine-fentanyl for caudal block. Anesthesiol Pain Med. 2016;6(5).
15. Belzarena SD. Clinical effects of intrathecally administered fentanyl in patients undergoing cesarean section. Anesth Analg. 1992;74(5):653-657.
16. Khosravi F, Alishahi M, Khanchemehr Y, Jarineshin H. A comparison between the effects of preloading with Ringer's solution and voluven on hemodynamic changes in patients undergoing elective cesarean section under spinal anesthesia. Med Arch. 2019;73(1):44.
17. Sun Y, Xu Y, Wang G-N. Comparative evaluation of intrathecal bupivacaine alone, bupivacaine-fentanyl, and bupivacaine-dexmedetomidine in caesarean section. Drug Res. 2015;65(09):468-472.
18. Jain N, Mathur PR, Soni P, Patodi V, Sethi SK, Mathur V. A comparative clinical study of intrathecal bupivacaine 2.5 mg with dexmedetomidine 5µg versus intrathecal bupivacaine 2.5 mg with fentanyl 25µg on the duration of labor analgesia using combined spinal epidural technique. J Obstet Anaesth Crit Care. 2019;9(1):24-29. Doi: 10.4103/joacc.JOACC_21_18
19. Rahimzadeh P, Faiz SHR, Imani F, Derakhshan P, Amniati S. Comparative addition of Dexmedetomidine and fentanyl to intrathecal bupivacaine in orthopedic procedure in lower limbs. BMC Anesthesiol. 2018;18(1):62.
20. Jarineshin H, Baghaei AA, Fekrat F, Kargar A, Abdi N, Navabipour S, Zare A, Akhlaghi H. Comparison of two different doses of dexmedetomidine in attenuating cardiovascular responses during laryngoscopy and endotracheal intubation: A double blind, randomized, clinical trial study. Journal of medicine and life. 2015;8(Spec Iss 4):45.
21. Nayagam HA, Singh NR, Singh HS. A prospective randomised double-blind study of intrathecal fentanyl and Dexmedetomidine added to low dose bupivacaine for spinal anesthesia for

lower abdominal surgeries. Indian J Anaesth. 2014;58(4):430.
22. Gupta R, Bogra J, Verma R, Kohli M, Kushwaha JK, Kumar S. Dexmedetomidine as an intrathecal adjuvant for postoperative analgesia. Indian J Anaesth. 2011;55(4):347.
23. Khosravi F, Sadeghi N, Jarineshin H. The effect of Dexmedetomidine on spinal anesthesia quality and hemodynamic changes in patients undergoing inguinal hernia repair surgery: intravenous versus intrathecal. Eur J Clin Pharmacol. 2020;76(7):923-928.
24. Arain SR, Ruehlow RM, Uhrich TD, Ebert TJ. The efficacy of Dexmedetomidine versus morphine for postoperative analgesia after major inpatient surgery. Anesth Analg. 2004;98(1):153-158.
25. Attri JP, Kaur G, Kaur S, Kaur R, Mohan B, Kashyap K. Comparison of levobupivacaine and levobupivacaine with fentanyl in infraumbilical surgeries under spinal anaesthesia. Anesthesia, Essays and Researches. 2015;9(2):178-184.
26. Nayagam HA, Singh NR, Singh HS. A prospective randomised double-blind study of intrathecal fentanyl and dexmedetomidine added to low dose bupivacaine for spinal anesthesia for lower abdominal surgeries. Indian Journal of Anaesthesia. 2014 Jul;58(4):430.
27. Harde M, Suryavanshi V, Sahu A, Wagh SK. Comparative study of ropivacaine and bupivacaine in bilateral ilioinguinal and iliohypogastric nerve block for post caesarean section analgesia. International Journal of Contemporary Medical Research. 2016;3(4):1167-71.