|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Original Research Article
Volume 5, Issue 8; August: 2021; Page No. 175-178

COMPARISON OF INTRATHECAL BUPRENORPHINE VERSUS CLONIDINE AS AN ADJUVANT TO 0.5% HYPERBARIC BUPIVACAINE IN LOWER ABDOMINAL SURGERIES

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Article Info: Received 15 June 2021; Accepted 05 August 2021
DOI: https://doi.org/10.32553/ijmbs.v5i8.2106
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Conflict of interest: No conflict of interest.

Abstract

Introduction: Present study was undertaken to compare the efficacy of intrathecal clonidine or buprenorphine with bupivacaine in lower abdominal surgeries.

Methods: 90 ASA I and II patients undergoing lower abdominal surgeries were randomly allocated into three groups(n=30). Group A received 3ml of 0.5% hyperbaric bupivacaine with 1ml normal saline, GroupB received 3ml of 0.5% hyperbaric bupivacaine with 60 mcg buprenorphine(1:5 dilution) and Group C received 3ml of 0.5% hyperbaric bupivacaine with 30mcg clonidine (1:5 dilution) respectively (Total volume 4ml). Onset time and duration of sensory and motor block, duration of analgesia, hemodynamics, VAS score, sedation score and side effect were compared.

Results: The duration of analgesia was significantly longest in GroupC (354.50±38.48min), followed by Group B (277.10±25.47min) and Group A(131.50±20.15min) ($p<0.001$)

Conclusion: Clonidine (30mcg) and buprenorphine (60mcg) when used as adjuvants to 0.5% hyperbaric bupivacaine intrathecally produces significantly longer duration and better quality of postoperative analgesia than bupivacaine alone.

Keywords: clonidine, buprenorphine, intrathecal, postoperative analgesia.

Introduction

Pain as defined by the International Association for the study of Pain (ISAP) is an "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage".[1]Lower abdominal surgeries may be performed under regional (spinal or epidural) or general anaesthesia. Spinal block is still the first choice because of its rapid onset, superior blockade, lower risk of infection, lesser failure rates, and cost-effectiveness but has the drawbacks of shorter duration of block and less postoperative analgesia.Local Anaesthetics when used alone is associated with short duration of action. Thus, early analgesic intervention is needed in postoperatively period. Various adjuvants have been used intrathecally to improve the quality and duration of spinal anaesthesia with better postoperative analgesia like epinephrine, neostigmine, midazolam, ketamine, fentanyl, buprenorphine, clonidine and dexmedetomidine.[2]With this background, this study was designed to compare the efficacy of intrathecal buprenorphine and clonidine with control group for onset and duration of sensory and motor block, duration of analgesia, sedation and to evaluate the side effects, if any.

Material and Methods

This was a randomized, double blind study, done at a tertiary care centre after the approval of the Institutional Ethical Committee and obtaining written informed consent from all patients after explaining the procedure in detail. 90 ASA I and II, aged 25-55yrs, of either sex, body weight 45-70kgs scheduled for lower abdominal surgeries under spinal anaesthesia were chosen for the study.

Preanaesthetic check-up was done one day prior to the surgery. Patients were evaluated for any systemic diseases and laboratory investigations recorded. The patients with contraindication to spinal anaesthesia (e.g. coagulation defects, infection at puncture site and allergy to drugs used) were excluded from the study.

The patients were educated about the use of visual analog scale (VAS) scoring system. On the day of surgery patients were randomly allocated into three groups (n=30) using sealed envelope technique.

After confirming overnight fasting, patient was taken on the operation table, was connected to monitors and baseline vitals like BP, pulse rate, respiratory rate was recorded. After an 18G intravenous cannula was inserted at the forearm level, lactated Ringer's solution was administered as a bolus of 10ml/kg before subarachnoid block to all patients.

Vitals were noted just before lumbar puncture. Spinal anaesthesia was performed at L3-L4 interspace with the patient in sitting position by using a 25G Quincke needle under strict aseptic conditions. Free flow of cerebrospinal

fluid was verified before injection of the anaesthetic solution 4ml volume, which was administered over 30 seconds. The drug compositions were according to group to which patients were allocated. Group A received 3ml of 0.5% hyperbaric bupivacaine with 1ml normal saline, Group B received 3ml of 0.5% hyperbaric bupivacaine with 1ml (60mcg) of buprenorphine (1:5 dilution) and Group C received 3ml of 0.5% hyperbaric bupivacaine with 1ml (30mcg) clonidine (1:5 dilution).The direction of the needle aperture was cranial during the injection. All patients were immediately placed in supine position. All the patients in three groups received identical volume (4ml) of study drug prepared in an identical syringe by an anaesthesiologist who was not involved in the anaesthetic management of the patients. Monitoring was done using continuous electrocardiography (lead II & V), heart rate, non-invasive blood pressure and continuous pulse oximetry ($Sp0_2$) and patients were given 4.0L/min of oxygen by venti-mask.Vitals were checked every 5 minutes for first 30 minutes then every 10 minutes till the end of the surgery. When adequate spinal block was achieved, the time from the end of intrathecal injection to readiness for surgery was recorded. Then the patient was positioned for planned surgery.

Sensory blockade was assessed every 2 minutes by pinprick test bilaterally in the midclavicular line by using 25G needle. The onset of sensory block defined as the time from the intrathecal injection of the study drug to the time taken to achieve T5-T6 level of sensory block. The highest level of the block and the time to achieve the same was noted. Regression of sensory block was defined as the time taken for the sensory block to regress up to two segments of dermatome from the highest level achieved.Motor blockade was assessed using Modified Bromage Scale. The onset of motor block was defined as the time taken to achieve complete motor block (Bromage Score-3). Duration of motor block was assessed by recording the time elapsed from the maximum to the lowest Bromage score (3-0).

Hypotension was defined as a fall of MAP by more than 30% from baseline or a fall in SBP below 90mmHg and it was treated with incremental doses of mephentermine 6mg IV and IV fluids. Bradycardia, defined as heart rate below 55bpm, was treated with injection atropine 0.3-0.6mg IV.

Postoperatively, the pain was assessed by using visual analogue pain scale (VAS) between 0 and 10 (0- no pain, 10- most severe pain). It was assessed every 30 minutes. Patients were allowed to receive rescue analgesics on VAS score of 3. Intravenous Diclofenac 75mg was given as rescue analgesic. This time from intrathecal injection to first administration of rescue analgesic (total duration of analgesia) was noted. This was the end point of our study. Postoperative sedation level was measured by using FOUR POINT SEDATION SCALE. The incidence of adverse effects such as nausea, vomiting, shivering, respiratory depression, sedation and hypotension were observed for 24 hours and managed.

Statistical Analysis

The sample size was calculated 30 cases for each of the 3 groups at α error 0.05 and power 80% assuming minimal detectable difference in mean time to first analgesic rescue with intrathecal buprenorphine, clonidine and control group to be 20 minutes with SD of 17.93 minutes so for the study purpose 30 cases were taken in each group (total 90 patients).

Statistical analysis was performed with SSPS (Statistical Package for the Social Sciences) software version 21 (SPSS inc., Chicago, IL,USA). Kruskal-Wallis H testwas used to assess differences among the three groups with respect to nonparametric variables. If this revealed significant differences, Mann-Whitney U- test was used to analyze differences between the groups in pairs. Parametric testing was done using analysis of variance.The categorial data were compared among groups using Chi square test. Data are presented as mean ± standard deviation or number of patients (percentage) as per category. Probability was considered to be significant if less than 0.05.

Results

The demographic data, such as age, sex, height, weight, ASA status, type of surgery and duration of surgery were comparable among the groups thereby not having any influence upon the outcomes. There was no statistically significant differences in the demographic variables between the groups (p>0.05)

Table 1: Characteristics of motor and sensory block

Parameters	Group A		Group B		Group C		P value		
	Mean	SD	Mean	SD	Mean	SD	A v/s B	A v/s C	B v/s C
Duration of analgesia (min)	131.50	20.15	277.10	25.47	354.50	38.48	P<0.001	P<0.001	P<0.001
2 segment regression(min)	94.00	24.41	121.60	12.28	166.50	23.34	P<0.001	P<0.001	P<0.001
Duration of motor block (min)	116.27	16.37	204.13	46.53	235.50	38.82	P<0.001	P<0.001	P<0.001
Onset of sensory block (min)	5.10	1.17	3.37	0.79	3.07	0.80	P<0.001	P<0.001	0.147
Onset of motor block(min)	5.68	1.44	4.15	0.82	4.03	0.59	P<0.001	P<0.001	0.529

Data presented as mean±SD. SD-Standard deviation, p<0.001 suggests statistically significant difference. Group A- Control; B-Buprenorphine; C-Clonidine. Statistical test- ANOVA test, Post Hoc turkey test.

Table 2: Incidence of intraoperative and early postoperative adverse effects

Variables	Group A		Group B		Group C		P value
	No.	%	No.	%	No.	%	
Hypotension	6	20.00	4	13.33	8	26.67	
Bradycardia	2	6.67	0	0	3	10.00	
Nausea & Vomiting	4	13.33	4	13.33	4	13.33	
None	18	60.00	24	80.00	15	50.00	0.355
Total	30	100.0	30	100.0	30	100.0	

Discussion

Effective postoperative pain control is an essential component of the care of the surgical patient. Inadequate pain control, apart from being inhuman, may result in increased morbidity or mortality.[9,10] Evidence suggests that surgery suppresses the immune system and that this suppression is proportionate to the invasiveness of the surgery. Good analgesia can reduce this deleterious effect.[11,12]

Regional analgesia have shown to improve surgical outcomes by decreasing intraoperative blood loss, postoperative catabolism, the incidence of thromboembolic events and by improving vascular graft blood flow and postoperative pulmonary function.[13]Spinal anaesthesia is a commonly used regional anaesthesia technique for lower limb and lower abdominal surgeries owing to its well-known advantages like quick onset, excellent sensory and motor block and avoidance of complications of general anaesthesia.[9]Various studies in the past have established the role of clonidine and buprenorphine as an adjuvant to local anaesthetic.

The antinociceptive properties of clonidine indicate that it might be useful as an alternative to intrathecal opioids for postoperative analgesia.[14] The growing interest in alpha 2 agonist for intrathecal use has motivated innumerable research due to its ability to improve anaesthesia and neuraxial analgesia without the side effects of opioids such as respiratory depression, pruritis and urinary retention.

With this background a comparative study was performed to know the effectiveness of intrathecal buprenorphine versus clonidine as adjuvants to 0.5% hyperbaric bupivacaine in patients undergoing lower abdominal surgeries in relation to time of onset and duration of motor and sensory block and duration of analgesia. Incidence of side effects were also noted and compared.Our study showed that patients receiving 0.5% Bupivacaine had least duration of analgesia (131.50 minutes) whereas addition of 60 μg buprenorphine to 0.5% bupivacaine, the duration increased to 277.10minutes but when 30μg clonidine was used as an adjuvant, the duration was maximally prolonged upto 354.50 minutes. Our results have been strengthened by findings of **Rashmi Pal et al**[6] who demonstrated prolonged analgesia with 50mcg clonidine(353.19±7.69min) and 75mcg buprenorphine (294.00±17.93min). When clonidine used intrathecally prolongs the analgesic action by acting spinally through the activation of postsynaptic alpha2 receptors in substantia gelatinosa of spinal cord[15,16]and block the conduction of C and A delta fibres.[3]

Our results were further strengthened by findings of **Negi AS et al**[5] who showedduration of analgesia was more with 37.5mcg clonidine (355.80±63.85 min) as compared to 75mcg buprenorphine (283.20±51.84 min). Similarly, **Srinivasagam K et al**[7] also found addition of 50 mcg clonidine to hyperbaric bupivacaine increases the duration to first time of rescue analgesia. Similar results were shown by **Lomate P et al**[8] who used 30mcg clonidine. We also used 30 mcg clonidine in our study which showed similar results to all above studies.

The onset of sensory and motor block was not prolonged in clonidine and buprenorphine.Our results were supported by the study done by **Lomate P et al**[8],**RashmiPal et al**[6]and**Srinivasagam K et al**[7]. The duration of sensory block and motor block was more with clonidine as compared to buprenorphine and control group. **Lomate P et al**[8] observed similar results which used 30mcg clonidine in their study.

In our study hemodynamic parameterswere comparable at different time intervals intraoperatively and postoperatively. Many studies who have used very low doses of intrathecal clonidine such as 15-30 mcg[2,4]in humans found no hemodynamic instability which is proven in our study as we have used low dose clonidine (30mcg).Our findings are similar to study done by **Negi AS et al**[5] who had used 37.5mcg clonidine in patients undergoing lower limb surgeries showed no hemodynamic instability.

In our study, postoperative sedation score was highest with clonidine group. Patients developed sedation as assessed by sedation scores but were easily arousable.

On comparing the three groups with regards to adverse effects like hypotension, bradycardia, nausea, vomiting, respiratory depression and shivering the difference was statistically insignificant. **Srinivasagam K et al**[7] reported increased incidence of hypotension and bradycardia with 50mcg of clonidine. This difference could be due to the use of lower doses (30mcg) in our study. One limitation of our study was that a therapeutic end point of VAS score 3 or request for analgesic was used. 24 hours total analgesic requirements were not recorded which would have better demonstrated the analgesic qualities of the studied drugs. However, our study found buprenorphine and clonidine both prolonged analgesia and decreased postoperative VAS scores.

Conclusion

Both buprenorphine (60mcg) and clonidine (30mcg) were effective and safe as adjuvants to 0. 5% hyperbaric bupivacaine when given intrathecally in patients undergoing lower abdominal surgeries. Clonidine appeared to be better in terms of prolongation of the duration of analgesia as compared to buprenorphine. Clonidine provide adequate sedation in postoperative period without significant postoperative complications.

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