



Original Research Article

Evaluating the effect of intramuscular dexmedetomidine or clonidine on the duration of anaesthesia and analgesia for lower abdominal surgeries under sub-arachnoid block

Sasha MM¹, Shailaja S^{2,*}¹Dept. of Anaesthesia, St John's Medical College, Bangalore, Karnataka, India²Dept. of Anaesthesia, Father Muller Medical College, Mangalore, Karnataka, India

ARTICLE INFO

Article history:

Received 16-10-2019

Accepted 07-12-2019

Available online 28-02-2020

Keywords:

Dexmedetomidine

Lower abdominal surgeries

Analgesia

ABSTRACT

Introduction: Spinal anaesthesia in the form of subarachnoid block is the common modality of anaesthesia for lower abdominal surgeries. However, its main drawback is the limited duration of anaesthesia and analgesia. To overcome this several adjuncts to spinal anaesthesia have been tried by various routes to prolong the duration of action. We aimed at evaluating the effect of intramuscular Dexmedetomidine or Clonidine on the anaesthetic and analgesic effect after subarachnoid Bupivacaine.

Materials and Methods: 90 patients undergoing lower abdominal surgeries were randomized to 3 groups of 30 each to receive normal saline or 1 µg/kg Dexmedetomidine or 2 µg/kg Clonidine intramuscularly 30 minutes prior to spinal anaesthesia. Patient's sedation score, duration of sensory, motor block and request for first analgesic following surgery were noted.

Results: Baseline characteristics were comparable among the 3 groups, the onset time of sensory and motor block was not different for the 3 groups. Sedation was greater for the Dexmedetomidine and Clonidine group than the control. Duration of anaesthesia and analgesia was significantly prolonged in Dexmedetomidine group when compared to the others.

Conclusion: Intramuscular Dexmedetomidine or Clonidine given by intramuscular route prior to lower abdominal surgeries prolongs the duration of anaesthesia and analgesia without causing significant side effects.

© 2020 Published by Innovative Publication. This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by/4.0/>)

1. Introduction

Sub-arachnoid block is the most commonly used modality of Spinal anaesthesia for lower abdominal surgeries. The major benefits of Spinal anaesthesia over general anaesthesia for lower abdominal surgeries are that it avoids the negative side effects of General anaesthesia drugs, suppression of surgical stress response, preservation of peri-operative immune function, reduction of incidence of venous thrombotic disease, pulmonary embolism, it facilitates early ambulation, is cost effective and useful in cases of difficult airway.¹ The main drawback of spinal anaesthesia is its unpredictable or short duration

of anaesthesia and analgesia. Various modalities are used to prolong the duration of action of local anaesthetics and reduce the requirement of supplemental analgesics adjuvants such as opioids, alpha 2 adrenergic agonist, magnesium sulphate etc have been used intrathecally along with Bupivacaine.^{2,3}

The alpha 2 adrenergic agonists Clonidine and Dexmedetomidine have been used to prolong post-operative anaesthesia and analgesia. These alpha 2 adrenergic agonists potentiate the effect of local anaesthetics and increase the duration of sensory and motor block, they also prolong analgesia duration. Clonidine and Dexmedetomidine have been used by oral, intramuscular, intravenous and intrathecal routes to achieve these outcomes.⁴⁻⁶ There is sparse evidence in literature

* Corresponding author.

E-mail address: drshaila@fathermuller.in (Shailaja S).

regarding the premedicant effect of intramuscular Clonidine or Dexmedetomidine on the duration of anaesthesia and analgesia, thus we proposed to do the study with the following aims:

1. To evaluate the duration of anaesthesia and analgesia following intramuscular Dexmedetomidine or intramuscular Clonidine for lower abdominal surgeries under sub-arachnoid block
2. To compare the effects of intramuscular Dexmedetomidine with intramuscular Clonidine used as premedicant for lower abdominal surgeries

2. Materials and Methods

The study protocol was approved by Institutional Ethics Committee and following which we conducted this prospective randomized study on 90 consenting participants posted for inguinal hernia or total abdominal hysterectomy surgeries. We included the following patients in our study - participants of either sex, aged between 17-61 years of American Society of Anaesthesiologists physical status I or II posted for open inguinal hernia repair or open abdominal hysterectomy under sub-arachnoid block. Exclusion criteria were - patients with contraindications for sub-arachnoid block, patient refusal, pregnancy, obesity, cardiac diseases, bleeding diathesis, emergency surgeries and patients on pre-operative beta blockers or alpha 2 adrenergic agonists.

Sample size calculation was done using previously published study Sushanta Halder in which the mean duration of motor blockade was 228.3 ± 50.4 minutes.⁷ A 20% increase in the duration following intramuscular Dexmedetomidine was considered clinically significant. Using alpha of 0.05 and a power of 0.9, the required sample size was 28 per group. The decision was made to include 30 subjects per group.

All patients underwent a thorough pre-anaesthetic evaluation on the previous day of surgery including a detailed history and focused clinical, airway and spine examination. After explaining the procedure, participant information sheet given and following signature on written consent form patients were taught about the use of Numeric Rating Scale for pain scoring prior to surgery. All participants received Tab. Diazepam 0.1mg/kg during the night and were given Nil Per Oral orders of 8 hours for solids. Patients were randomized by random number table generated by a computer and sealed envelope techniques was used for segregating the patients into 3 groups of 30 participants each. The drug solution was prepared by another anaesthetist not involved in collection of data.

All patients received the premedicant drug 30 minutes before spinal anaesthesia and vitals were monitored thereafter.

Group A - Intramuscular normal saline 2 ml administered to 30 participants

Group B - $1 \mu\text{g}/\text{kg}$ of Dexmedetomidine intramuscularly diluted up to 2 ml with normal saline was given to 30 participants

Group C - $2 \mu\text{g}/\text{kg}$ of Clonidine intramuscularly diluted up to 2 ml with normal saline was given to 30 participants

Baseline pre injection and post injection vitals were noted down, intravenous access started and ringers lactate given at rate of 10 ml/kg over 30 minutes. Half an hour later all patients received subarachnoid block in L₃ - L₄ intervertebral space under strict aseptic precautions using a 25 Gauge Quincke Babcock's needle. Bupivacaine heavy 3.5 ml (17.5 mg) was injected following free flow of CSF. This timing was noted down as time 0 for recording data. Sensory testing done using pinprick method with a 25-gauge hypodermic needle. The time taken to reach T₈ level was noted down. Motor blockage was assessed by using the commonly used scale - Modified Bromage Scale. Sedation score was assessed using the most widely used scale - Ramsay's Sedation Scale (RSS) on arrival to the Operating Room, then - 10 minutes after spinal anaesthesia and finally in the post-operative ward. Patients with a RSS of more than 3 at 10 minutes after spinal anaesthesia were considered to be anxious and received 1 mg of IV Midazolam.

Intra-operative recording included Heart rate, pulse oximetry saturation, respiratory rate and blood pressure every 3 minutes for 15 minutes and then every 5 minutes till completion of surgery. For this study hypotension was defined as 30% drop in systolic blood pressure from baseline and was treated with intravenous fluid bolus and IV Mephenteramine 3 mg aliquots, bradycardia was defined as heart rate less than 50/minute and treated with IV Atropine 0.6 mg. The incidence of side effects such as hypotension, bradycardia, shivering, nausea, vomiting, pruritus, respiratory depression or changes in electrocardiogram were noted. Patients with intra-operative shivering received injection pethidine 25 mg intravenously.

Post-operative haemodynamics and oxygen saturation monitored. Duration of surgery was recorded. Duration of analgesia for this study was taken as time from administration of sub-arachnoid block up to the administration of first supplemental rescue analgesia, when patient complained of pain or when numeric pain rating scale was more than 3.

2.1. Statistical analysis

The collected data was entered into SPSS -16.0 and analysed. Categorical variables such as sex, type of surgery, co-morbidities, shivering and Ramsay Sedation scale were analysed using descriptive and frequencies. Numerical continuous variables such as onset of sensory and motor blockade, heart rate, blood pressure and time for request of analgesia were measured for central tendency using mean and standard deviation. ANOVA was used to compare between the 3 groups.

3. Results

The three groups were comparable with respect to age, weight, sex, ASA physical status, co-morbidities, heart rate and blood pressure reading in the ward and during intramuscular injection as shown in Table 1. The time to attain sensory and motor blockade, duration of surgery, intravenous fluid requirement and incidence of post-operative nausea and vomiting was comparable among the 3 groups. As depicted in Table 1.

Sedation and anxiolysis was measured using Ramsay sedation scale on arrival to OR showed that 1 patient in dexmedetomidine group and 11 patients in normal saline group had RSS of more than 3 score, 10 minutes after sub-arachnoid block 1 patient in dexmedetomidine group, 3 patients in clonidine group and 12 patients in normal saline group had RSS more than 3 requiring injection midazolam, post-operatively 4 patients in the normal saline group had RSS more than 3 while none in dexmedetomidine or clonidine group were anxious. There was clinically and statistically significant difference between the normal saline group and the premedicant groups with respect to anxiolysis as shown in Table 2.

Significant number of cases in Dexmedetomidine group experienced bradycardia requiring inj Atropine. The number of patients who experience intra-operative hypotension requiring injection mephenteramine or intravenous fluid bolus were similar in all 3 groups. Intraoperative vital parameters were comparable between the 3 groups.

In the present study the time required for complete motor recovery was 214.5 minutes in normal saline group, 234 minutes in clonidine group and 241.16 minutes in Dexmedetomidine group. Time for complete sensory recovery was 245.16 minutes in normal saline group, 277.66 minutes in clonidine group and 281.83 minutes in Dexmedetomidine group, the difference between the groups was statistically significant. The time for request of first analgesia for the groups are – normal saline 211.33 minutes, 267 minutes for clonidine group and 300.66 minutes for Dexmedetomidine group, the difference was clinically significant and statistically significant between the three groups with maximum analgesic time for the Dexmedetomidine group as shown in Table 2.

4. Discussion

Alpha 2 adrenergic agonists namely Clonidine and Dexmedetomidine have been used as a premedicant by various routes to prolong anaesthesia and for analgesia. In the present study we selected 2µg/kg Clonidine and 1µg/kg Dexmedetomidine for intramuscular route as smaller than these doses had proved ineffective to produce the required effect as observed by Aho, Scheinin and Wright and larger than these doses have shown to increase the incidence of bradycardia and hypotension.^{8–10} Scheinin had also stated

that the maximum effect of IM Dexmedetomidine occurred between 60-150 minutes after injection while Singh M found that IM Clonidine took 30-60 minutes post injection, hence in our study we administered the drug 30 minutes prior to giving spinal anaesthesia.^{11,12}

The age distribution, gender, weight of patients, type of surgery, the time for attainment of sensory and motor blockade were comparable between the three groups. However, the duration of anaesthesia in form of sensory and motor blockage was prolonged in Dexmedetomidine and Clonidine groups when compared to control group, similar findings are quoted by Omprakash who had administered Dexmedetomidine, Clonidine or saline as adjuvants to Bupivacaine in subarachnoid block.¹³ The time for request of rescue analgesic was prolonged in Dexmedetomidine and Clonidine groups when compared to saline group. Similar findings were stated by Omprakash, Sidda Reddy and Zhang in their studies.^{13–15} The duration of analgesia in the form of request for first rescue analgesic was more prolonged in Dexmedetomidine group when compared to Clonidine, reason being Dexmedetomidine differs from Clonidine by being eight to ten times more selective to α_2 adrenoceptors especially for α_{2A} and α_{2C} subtype of this receptor.

Hypotension and bradycardia are recognized side effects of administration of Dexmedetomidine or Clonidine, hence we have used low doses of these drugs, however significant number of patients in the Dexmedetomidine experienced hypotension warranting injection atropine. Similar finding was noted by Karaaslan, Yang Sun and Aho in their studies.^{8,16,17} Hypotension requiring IV fluids and inj Mephenteramine was similar in all the three groups.

Dexmedetomidine and Clonidine act on Locus Ceruleus and the Dorsal Raphe Nucleus in the central nervous system to produce sedation and analgesia. In our study we monitored sedation scale using Ramsay Sedation Scale at the start of Subarachnoid block i.e 30 minutes after intramuscular injection, 10 minutes after spinal anaesthesia and in the post-operative period. We found that significant number of patients in the control group had lower RSS requiring injection midazolam at 10 minutes after spinal anaesthesia following which during the intra-operative period there was no difference between the groups. Similar anxiolysis was observed by Sun Yung who administered 1 µg/kg Dexmedetomidine IM before induction of anaesthesia.¹⁷ In the post-operative period Dexmedetomidine and Clonidine groups exhibited greater RSS. This sedation and anxiolysis effect is due to presynaptic activation of α_2 adrenoceptors in Locus ceruleus which inhibits release of norepinephrine and results in sedation and anxiolysis.¹⁸ Similar findings were quoted by Karaaslan, Aho, Taittonan, Sidda Reddy and Tarek in their studies.^{8,14,16,19}

Table 1: Patient characteristics

Parameter	Dexmedetomidine	Clonidine	Normal saline	Significance (P value)
Age in years (Mean)	43.9±13.2	42±11.56	46.7±14.99	0.122
Weight in kgs (Mean)	58.3±10.33	57.9±12.75	61.7±11.56	0.255
Sex	Male	14	11	0.14
	Female	16	19	
ASA PS	I	27	25	0.304
	II	3	5	
Co-morbidities	HTN	1	2	0.162
	DM	1	3	
	COPD	1	0	
	Nil	27	25	23
Ward HR (mean) beats/min	77.73	81.8	77.33	0.329
Ward BP (mean) mmHg	127/82	130/82	133/83	0.827
Baseline – Heart rate (mean) beats/min	78.36	86.06	80.93	0.085
Baseline – BP (mean) mmHg	128/83	136/85	134/85	0.473

ASA PS – American Society of Anaesthesiologist physical status
HR – Heart Rate, BP – Blood Pressure.

Table 2: Peri-operative patient characteristics

Ramsay sedation scale more than 3 (number of patients)	On arrival to OR	1	0	11	0.002
	10 minutes after spinal anaesthesia	1	3	12	0.001
	Post - operatively	0	0	4	.011
Time for onset of sensory block (mean) seconds		133	120	128	0.13
Time for onset of motor blockade (mean) seconds		178	161	166	0.09
Duration of surgery (mean) minutes		97.46±33.3	100±31.56	93.83±31.99	0.76
IVF bolus – number of cases which required		5	2	9	0.069
Mephenteramine required (number of cases)		16	20	20	0.202
Intra – operative bradycardia requiring inj. (number of cases)	Atropine	12	7	6	0.05
Nausea/vomiting (number of cases)		0	0	1	0.112
Post-operative shivering (number of cases)		2	2	1	0.392
Post –operative HR (mean)		69.46	71.16	76.73	0.056
Post – operative SBP (mean)		117.26	118.13	126.86	0.02
Post – operative DBP (mean)		76.53	76.26	78.03	0.66
Time for request of first analgesic after anaesthesia (mean) minutes		300.66±116.84	267.00±99.3	211.33±60.84	0.002
Time of Motor recovery (mean) minutes		241.16±28.09	234.00±37.47	214.50±55.72	0.04
Time of Sensory recovery (mean) minutes		281.83±26.73	277.66±34.10	245.16±64.52	0.004

5. Conclusion

From the present study we conclude that Clonidine or Dexmedetomidine given by intramuscular route prior to spinal anaesthesia for lower abdominal surgeries increases the duration of anaesthesia by prolonging the sensory and motor block. It also accentuates intraoperative and post-operative sedation and prolongs the time for request of first rescue analgesic.

6. Source of funding

None.

7. Conflict of interest

None.

References

1. Metry AA, Nakhla GM, Wahba WZ, Wahba RM, Kamel IH. Abdominoplasty under Spinal Anesthesia: A Feasibility Study. *Anesth Essays Res.* 2019;13(2):243–247.
2. Thanda B, Khare A, Sethi SK, Meena S, Verma M. Comparison of dexmedetomidine and fentanyl as intrathecal adjuvants to 0.5% hyperbaric bupivacaine for total abdominal hysterectomy under

- subarachnoid block: A prospective randomized double blind study. *Anaesth Pain Intensive Care*. 2017;21(1):65–72.
3. Buvanendran A, Mccarthy RJ, Kroin JS. Intrathecal magnesium prolongs fentanyl analgesia: a prospective, randomized, controlled trial. *Anesth Analgesia*. 2002;95:661–666.
 4. Agarwal A, Agarwal S, Payal YS. Comparison of block characteristics of spinal anesthesia following intravenous dexmedetomidine and clonidine. *J Anaesthesiol Clin Pharmacol*. 2016;32(3):339–343.
 5. Kumari R, Kumari A, Kumar S, Singh R. Intravenous dexmedetomidine as an adjunct to subarachnoid block: A simple effective method of better perioperative efficacy. *J Anaesthesiol Clin Pharmacol*. 2017;33(2):203–208.
 6. Jayaram L, Sinha A, Punhani D. A comparative study to evaluate the effect of intranasal dexmedetomidine versus oral alprazolam. *J Anaesthesiol Clin Pharmacol*. 2013;29(2):179–182.
 7. Halder S, Das A, Mandal D, Chandra M, Ray S, et al. Effect of Different Doses of Dexmedetomidine as Adjuvant in Bupivacaine -Induced Subarachnoid Block for Traumatized Lower Limb Orthopaedic Surgery: A Prospective, Double-Blinded and Randomized Controlled Study. *J Clin Diagn Res*. 2014;8(11):1–06.
 8. Aho M, Scheinin M, Lehtinen AM, Erkola O, Vuorinen J, Korttila K. Intramuscularly administered dexmedetomidine attenuates hemodynamic and stress hormone responses to gynecologic laparoscopy. *Anesth Analg*. 1992;78(6):1065–1075.
 9. Scheinin H, Jaakola ML, Sjoval S. Intramuscular dexmedetomidine as premedication for general anaesthesia. A comparative multicentre study. *Anesthesiol*. 1993;78(6):1065–1075.
 10. Wright PM, Carabine UA, McClune S, Orr DA, Moore J. Preanaesthetic medication with clonidine. *Br J Anaesth*. 1990;65(5):628–632.
 11. Scheinin H, Karhuvaara S, Olkkola KT. Pharmacodynamics and pharmacokinetics of intramuscular Dexmedetomidine. *Clin Pharmacol Ther*. 1992;52:537–546.
 12. Singh M, Choudhury A, Kaur M, Liddle D, Verghese M, Balakrishnan I. The comparative evaluation of intravenous with intramuscular clonidine for suppression of hemodynamic changes in laproscopic cholecystectomy. *Saudi J Anaesth*. 2013;7(2):181–186.
 13. Suthar O, Sethi P, Sharma UD. Comparison of dexmedetomidine and clonidine as an adjuvant to intrathecal bupivacaine in lower limb surgery: A randomised, double-blind, placebo controlled trial. *Anaesth Pain Intensive Care*. 2015;19(2):147–152.
 14. Reddy VS, Shaik NA, Donthu B, Sannala V, Jangam V. Intravenous dexmedetomidine versus clonidine for prolongation of bupivacaine spinal anaesthesia and analgesia: A randomized double-blind study. *J Anaesthesiol Clin Pharmacol*. 2013;29(3):342–347.
 15. Zhang H, Li M, Zhang S, Fu M, Zhang SY. Intravenous Dexmedetomidine promotes Spinal Bupivacaine Anaesthesia and Postoperative Analgesia in Lower Limb Surgery: A Double-Blind Randomized clinical CONSORT Study. *Medicine (Baltimore)*. 2016;95(8):2880–2880.
 16. Karaaslan D, Peker TT, Alaca A, Ozmen S, Yorgancigil H. Comparison of buccal and intramuscular dexmedetomidine premedication for arthroscopic knee surgery. *J Clin Anesth*. 2006;18(8):589–93.
 17. Sun Y, Liu C, Zhang Y, Luo B, She S, Xu L. Low dose intramuscular Dexmedetomidine as premedication: A randomized clinical trial. *Med Sci Monit*. 2014;20:2714–2719.
 18. Jones M, Maze M. Can we characterize the central nervous system action of $\alpha 2$ adrenergic agonist? *Br J Anaesth*. 2001;86(1):1–3.
 19. Tammam T, Wahba S. Quality of MRI pediatric sedation: Comparison between intramuscular and intravenous dexmedetomidine. *Egypt J Anaesth*. 2013;29:47–52.

Author biography

Sasha MM Assistant Professor

Shailaja S Associate Professor

Cite this article: Sasha MM , Shailaja S . Evaluating the effect of intramuscular dexmedetomidine or clonidine on the duration of anaesthesia and analgesia for lower abdominal surgeries under sub-arachnoid block. *Indian J Clin Anaesth* 2020;7(1):182-186.