Research Article

Anesthetic efficacy of dexmedetomidine and acetaminophen in intravenous regional anesthesia

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Abstract

Introduction: The ideal intravenous regional anesthesia solution should have the following features: rapid onset reduced tourniquet pain and prolonged post-deflation analgesia, local anesthetics alone are not able to bestow all such attributes to the IVRA solutions; hence multiple adjuncts like opioids, tramadol, nonsteriodal anti-inflammatory drug, clonidine, dexmedetomidine, muscle relaxants, potassium, magnesium, ketamine and alkalinisation with sodium bicarbonate have been used to improve the overall quality of anesthesia and analgesia. **Aims and objective:** To evaluate the anesthetic effectiveness of dexmedetomidine and acetaminophen when administered as adjuncts to lidocaine in intravenous regional anesthesia. **Materials and method:** The present study was undertaken in the department of anesthesiology and intensive care in government medical college, Jammu. It comprised of 90 healthy adult patients of either sex, not having any systemic illness, who were scheduled for hand or forearm surgery and they were divided into three groups of thirty patients each. After appropriate premedication, the patients in Group I was given intravenous regional anesthesia with 10ml of preservative free lidocaine 2% diluted with normal saline to a total volume of 40 ml. Group II patients were given intravenous regional anaesthesia with 10 ml of preservative free lidocaine 2% mixed with 0.5 ug/kg of dexmedetomidine diluted with normal saline to make a total volume of 40 ml. Group III patient were given intravenous regional anaesthesia with 10 ml of preservative free lidocaine 2% mixed with 30ml (300mg) of paracetamol (acetaminophen) to total volume of 40 ml. The onset of sensory and motor block in minutes was recorded. Intra-operative degree of analgesia was evaluated on the basis of visual analogue scale (VAS) (0=no pain and 10 = 'worst pain imaginable'). Quality of intraoperative anesthesia was assessed as per following scale: Excellent (4): no complaint from the patient. Good (3): minor complaint with no need of supplemental analgesics. Moderate (2): complaint that required supplemental analgesic. **Results:** All the three groups were comparable in age and weight distribution and there was statistically insignificant difference among them. The addition of 0.5ug/kg of dexmedetomidine to lidocaine for IVRA shortened the onset of sensory and motor block and improved the quality of anaesthesia. The addition of 300mg of acetaminophen to lidocaine for IVRA only shortened the onset of sensory block without affecting the motor block onset time. There was improved quality of anesthesia. Sensory and motor block recovery times were not affected but there was significantly increased duration of postoperative analgesia and negligible side effects. In group II, 28(93.3%) patients had excellent quality of anesthesia score, 2(6.6%) had good quality of anesthesia score. In group III, 20(66.6%) patients had excellent quality of anesthesia score, 15(50%) had good quality of anesthesia score, and 5 (16.6%) had moderate quality of anesthesia score. In group II and III, no patient had moderate score. **Conclusion:** Thus we conclude that the addition of dexmedetomidine or acetaminophen to lidocaine in intravenous regional anesthesia definitely improve the quality of anesthesia and analgesia to a variable extent. However, dexmedetomidine is more potent, and provides better quality of anesthesia and analgesia.

Key words: IVRA, dexmedetomidine, acetaminophen, Anesthetic efficacy.

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Received Date: 27/05/2015 Revised Date: 03/06/2015 Accepted Date: 06/06/2015

Access this article online

Quick Response Code:

Website: www.statperson.com

DOI: 08 June 2015

INTRODUCTION

Intravenous regional anaesthesia (IVRA) was first described in 1908 by August karl Gustav Bier, a German surgeon and pioneer of spinal anesthesia, for anesthesia of forearm and hand. He described a new method of producing analgesia of limb which he named 'vein anesthesia'. His method, which now bears his name,

How to site this article: Mukta Jitendra, Monika Dabgotra, Rajesh Mahajan, Smriti Gulati. Anesthetic efficacy of dexmedetomidine and acetaminophen in intravenous regional anesthesia. *International Journal of Recent Trends in Science and Technology* June 2015; 15(2): 283-286 http://www.statperson.com (accessed 09 June 2015).

consisted of occluding the circulation in a segment of the arm with two bandages and injecting dilute local anesthetic through a venous cut down in this isolated segment, which resulted in prompt analgesia[1]. The earliest agent injected was prilocaine. The technique gained popularity when Holmes used lidocaine and introduced several modifications, including either a second cuff or subcutaneous band of local anesthesia to control tourniquet pain.[2] The ideal intravenous regional anesthesia solution should have the following features: rapid onset reduced tourniquet pain and prolonged post-deflation analgesia, local anesthetics alone are not able to bestow all such attributes to the IVRA solutions; hence a multiple of adjuncts like opioids, tramadol, nonsteriodal anti-inflammatory drug, clonidine, dexmedetomidine, muscle relaxants, potassium, magnesium, ketamine and alkalinisation with sodium bicarbonate have been used to improve the overall quality of anesthesia and analgesia.[3,4] Studies have been conducted to establish the efficacy of drugs as adjuncts to lidocaine in intravenous regional anesthesia. In the present study we tried to establish the anesthetic and analgesic effectiveness of dexmedetomidine and acetaminophen as adjuncts to lidocaine in intravenous regional anesthesia.

AIMS AND OBJECTIVE

To evaluate the anesthetic effectiveness of dexmedetomidine and acetaminophen when administered as adjuncts to lidocaine in intravenous regional anesthesia.

MATERIALS AND METHOD

The present study was conducted in the department of anesthesiology and intensive care of government medical college, Jammu. After obtaining approval from hospital ethical committee, the study was conducted on ASA physical status I and II patients aged between 20-25 years, of either sex, scheduled for hand or forearm surgery, lasting less than one hour duration. Pre-anesthetic check-up was done a day before surgery including detailed history, a thorough general physical and systemic examination and relevant investigations.

Informed consent was taken from each patient and patient was kept fasting overnight. Patients were given tabl*et al.*prazolam 0.25 mg the night before surgery and 0.25 mg again in the morning 2 hours prior to surgery. Injection glycopyrrolate 0.2 mg was given intramuscularly 45 minutes before the surgical procedure and injection tramadol 1 mg/kg body weight intravenously was given 5 minutes prior to application of esmarch,s bandage. Intradermal test for lidocaine sensitivity was done in all patients.

The patients were divided randomly into three groups of 30 patients each.

- **GROUP I:** patients in this group received 10ml of preservative free lidocaine 2% diluted with saline to a total volume of 40ml.
- **GROUP II:** patients in this group received 10 ml of preservative free lidocaine 2 % and 0.5ug/kg of dexmedetomidine [i.e.0.5 ml for a 50 kg adult] mixed with saline to a total volume of 40 ml.
- **GROUP III:** patients in this group received 10 ml of preservative free lidocaine 2% mixed with 30 ml (300 mg) of paracetamol solution to make a total volume of 40 ml.

The onset of sensory and motor block in minute was recorded. Intra-operative degree of analgesia was evaluated on the basis of visual analogue scale (VAS) (0=no pain and 10 = 'worst pain imaginable'). Quality of intraoperative anesthesia was assessed as per following scale: Excellent (4): no complaint from the patient. Good (3): minor complaint with no need of supplemental analgesics. Moderate (2): complaint that required supplemental analgesic.

The collected data was analyzed using computer software Microsoft excel and SPSS version 10.0 for windows. The data was presented as mean and standard deviation and statistical significance was analyzed using one-way analysis of variance (ANOVA). Post-hoc intergroup significance was assessed using bonferroni's t test. Qualitative variable was analyzed using chi-square test.

RESULTS

Table 1: Distribution of demographics data

	Group I	Group II	Group III
Age (in years)	35.43 ± 7.15	34.93 ± 7.45	35.04 ± 7.19
Weight (in kg)	65.96 ± 5.35	68.80 ± 7.50	66.03 ± 7.95
Mean duration of surgery	48.03±18.0	50.36±10.0	48.9±13.0

The demographic data was comparable in three group and statistically there was insignificant difference among them (p-value >0.05 using ANOVA). The mean duration of surgery in group I was 48.03±18.0minutes; in group II was 50.36±10.0 minutes, and in group III was 48.9±13.0minutes; and there was statistically insignificant difference among three group (p-value >0.05 using ANOVA).

Table 2: Time required onset of Sensory and motor block

	Group I	Group II	Group III
onset of sensory block (minutes)*#$	5.20 ± 1.08	1.66 ± 0.55	4.53 ± 1.23
onset of motor block (minutes) *$	9.68 ± 1.72	5.45 ± 1.85	9.51 ± 2.83

* Statistically significant difference between group I and group II
\# Statistically significant difference between group I and group III
$ Statistically significant difference between group II and group III

The mean time of onset of sensory and motor block in group I was 5.20± 1.08 minutes and 9.68± 1.72 minutes; in group II was 1.66±0.55 minutes and 5.45±1.85 minutes; and in group III was 4.53± 1.23 minutes and 9.51±1.83 minutes, respectively.

Table 3: Comparison Visual analogue scale in 3 groups at different time periods

	Group I	Group II	Group III
10 minutes *	0.56 ± 0.50	0.13 ± 0.34	0.33 ± 0.47
20 minutes *#	0.93 ± 1.11	0.20 ± 0.40	0.26 ± 0.46
30 minutes *#	1.56 ± 1.40	0.30 ± 0.46	0.40 ± 0.49
40 minutes *#	1.23 ± 0.72	0.56 ± 0.50	0.66 ± 0.47
50 minutes *#	1.53± 0.57	0.73 ± 0.52	1.10 ± 0.75
60 minutes *#	1.90± 0.48	1.00± 0.52	1.30± 0.65

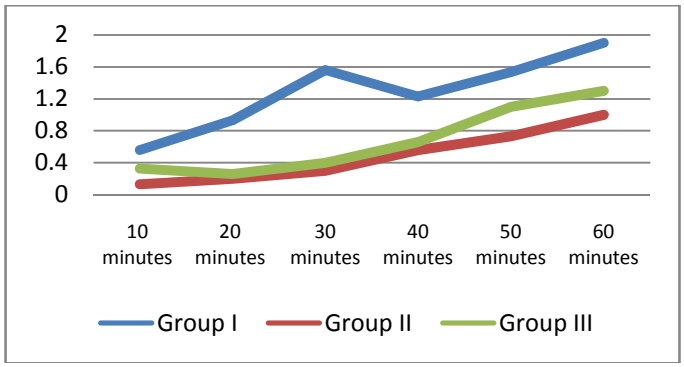

Figure 1: Comparison Visual analogue scale in 3 groups

It was observed that VAS score was increasing with increase in time. There was statistically significantly lower VAS in group II at 10, 20,30,40,50 and 60minutes when compared to control group by Bonferroni's t-test. There was statistically significantly lower VAS at 20,30,40,50and 60 minutes in group III when compared to control group. The difference was insignificant at 10 minutes (p>0.05).

Table 4: Distribution according quality of anesthesia

	Quality of anesthesia (no. of patients)		
	Excellent	Good	Moderate
Group I	10 (33.3%)	15 (50%)	5 (16.6%)
Group II	28 (93.3%)	2 (6.7%)	0 (0%)
Group III	20 (66.6%)	10 (33.3%)	0 (0%)

In group II, 28(93.3%) patients had excellent quality of anesthesia score, 2(6.6%) had good quality of anesthesia score. In group III, 20(66.6%) patients had excellent quality of anesthesia score, 15(50%) had good quality of anesthesia score, and 5 (16.6%) had moderate quality of anesthesia score. In group II and III, no patient had moderate score.

DISCUSSION

The present study was undertaken in the department of anesthesiology and intensive care in government medical college, Jammu comprised of 90 healthy adult patients of either sex, not having any systemic illness, who were scheduled divided into three groups of thirty patients each. After appropriate premedication, the patients in Group I was given intravenous regional anesthesia with 10ml of preservative free lidocaine 2% diluted with normal saline to a total volume of 40 ml. Group II patients were given intravenous regional anesthesia with 10 ml of preservative free lidocaine 2% mixed with 0.5 ug/kg of dexmedetomidine diluted with normal saline to make a total volume of 40 ml. Group III patient were given intravenous regional anesthesia with 10 ml of preservative free lidocaine 2% mixed with 30ml (300mg) of paracetamol (acetaminophen) to total volume of 40 ml. The entire three group were comparable with each other with respect to age and weight distribution and there was statistically insignificant difference among them (p-value>0.05). The mean duration of surgery in group I was 48.03±18.0minutes; in group II was 50.36±10.0 minutes, and in group III was 48.9±13.0minutes; and there was statistically insignificant difference among three group (p-value >0.05 using ANOVA). The mean time of onset of sensory and motor block in group I was 5.20± 1.08 minutes and 9.68± 1.72 minutes; in group II was 1.66±0.55 minutes and 5.45±1.85 minutes; and in group III was 4.53± 1.23 minutes and 9.51±1.83 minutes, respectively. Thus the mean onset of sensory and motor block was significantly lowered in group II as compared to group I and III. Similar findings were also observed by mizark *et al.*[5], Celik *et al.*[6], myoung *et al.*[7] and Yoshitomi *et al.*[8]. Intraoperative analgesia was assessed by visual analogue scale of 0-10. There was statistically significantly lower VAS in group II at 10, 20,30,40,50 and 60 minutes when compared to control group (p<0.001 using) Bonferroni's t-test. In the study conducted by Memis *et al.*[9], there was statistically significant difference in VAS score at 5,10,15,20 and 40 minutes in dexmedetomidine group (p-value <0.001) as compared to control group. Esmaoglu *et al.*[10], also observed significantly lower VAS score in the dexmedetomidine group with lesser requirement of intraoperative analgesics as compared to control group (p<0.05). Thus our results were comparable with these studies. Sato j *et al.*[11] reported that 2 adrenergic receptors located at nerve ending have a role in the analgesia effects of the drug by preventing norepinephrine release. Therefore, dexmedetomidine, by preventing nor-epinephrine release from nerve terminals, produced analgesic effects and thus, There was statistically significantly lower VAS was

observed at 20,30,40,50 and 60 minutes in group III when compared to control group ($p<0.05$). In a study conducted by Sen *et al.*[12] intraoperative VAS scores at 20 and 30 minutes were significantly lower in added to 0.5% lidocaine in IVRA but there was no difference in vas score at 40, 50 and 60 minutes between acetaminophen and control group. We observed lower VAS at 40, 50 and 60 minutes also in our study ($p>0.05$). Myoung *et al.*[7] observed no significant difference between acetaminophen and control group when compared against VAS score for tourniquet pain. However, we observed lower vas score is acetaminophen group as compared to control group in the intraoperative prior. Canbay *et al.*[13] reported that acetaminophen pretreatment appears to be effective in reducing the pain experienced during iv injection of propofol. This suggests the peripheral antinociceptive effects of acetaminophen. Deciga-c *et al.*[14] reported that which are more resistant to lidocaine than A-delta fibers, and to opening of potassium channels located in primary afferent nerve endings.

In the intergroup comparison between group II and III, there was statistically insignificant difference in the dexmedetomidine and acetaminophen group ($p>0.05$) suggesting that both the drugs significantly lower intraoperative vas scores are compared to control group and thus improve intraoperative analgesia.

In group II, 28(93.3%) patients had excellent quality of anesthesia score, 2(6.6%) had good quality of anesthesia score. In group III, 20(66.6%) patients had excellent quality of anesthesia score, 15(50%) had good quality of anesthesia score, and 5 (16.6%) had moderate quality of anesthesia score. In group II and III, no patient had moderate score. In the intergroup comparison between group I and II, since more number of patients in dexmedetomidine group had excellent score as compared to control group, dexmedetomidine provides better quality of anesthesia than control group. Memic *et al.*[9], also observed excellent quality of anesthesia score in dexmedetomidine group and good in control group and difference was statistically significant ($p<0.05$). In the intergroup compare between group I and III, since more number of patients in acetaminophen group had excellent score as compared to control group. Acetaminophen provides better quality of anesthesia than control group. Sen *et al.*[12] observed that anesthesia quality was excellent in acetaminophen group and good ($p<0.05$). Our findings were comparable to these studies. In the inter group comparison between group II and III, more percentage of patient in dexmedetomidine group had excellent quality of anesthesia score than the percentage of patients in acetaminophen group, suggesting that dexmedetomidine provides better quality of anesthesia than acetaminophen.

CONCLUSION

Thus we conclude that the addition of dexmedetomidine or acetaminophen to lidocaine in intravenous regional anesthesia definitely improve the quality of anesthesia and analgesia to a variable extent. However, dexmedetomidine is more potent, and provides better quality of anesthesia and analgesia.

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Source of Support: None Declared
Conflict of Interest: None Declared