Original Article

# Quality of anesthesia induced by dexmedtomidine and acetaminophen in regional anesthesia comparative study

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## Abstract

**Introduction:** Intravenous regional anaesthesia was first described in 1908 by August kar Gustav Bier, a German surgeon and pioneer of spinal anaesthesia, for anaesthesia of forearm and hand. He described a new method of producing analgesia of limb which he named 'vein anaesthesia'. August bier first presented his new method of intravenous regional anaesthesia at the 37th congress of the german surgical society on 22nd April 1908.Dexmedetomidine, an imidazole compound, is the pharmacologically active dextroisomer of medetomidine. It is a potent alpha-2 adrenoceptor agonist with eight times higher affinity for the alpha-2 adrenoceptor than clonidine, Alpha-2 agonists produce sedation, analgesia, hypnosis, anxiolysis and sympatholysis. **Aims and Objectives:** To evaluate the anaesthetic and analgesic effectivenss of Dexmedetomidine and acetaminophen when administered as adjuncts to lidocaine in intravenous regional anaesthesia to find out sensory and motor block onset times. **Methodology**: This was a clinical trial, in this patients were divided randomly into three group of 30 patients each. Patients were divided into **GROUP I:** Control Group, **GROUP II:** Dexmedetomidine. **GROUP III:** Paracetamol (Acetaminophen).The 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. A 'p' value of <0.05 was considered statistically significant. Qualitative variable was analyzed using chi-square test. All analysis was conducted in accordance to intention to treat principle. **Result:** Onset of sensory block was significantly lower in Group II and Group III as compared to Group III (0.0001), Onset of Motor block was significantly lower in Group II and Group III as compared to Group III (0.0001). Excellent Quality of anesthesia was significantly higher in Group II as compared other groups (0.00001). There was significantly lower Visual Analogue Scale in Group II as compared to other groups, among intra-operative analgesia at 10, 20, and 30,40,50,60. **Conclusion:** It is concluded that the addition of dexmedetomidine or acetaminophen to lidocaine in intravenous regional anaesthesia definitely improve the quality of anaesthesia and analgeisa to a variable extent. However, dexmedetomidine is more potent, and provides better quality of anaesthesia and analgesia, and prolongs the duration of postoperative analgesia more than acetaminophen

**Keywords:** Quality of Anesthesia, Dexmedtomidine, Acetaminophen.

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## INTRODUCTION

Intravenous regional anaesthesia (ivra) was first described in 1908 by August karl Gustav Bier, a German surgeon and pioneer of spinal anaesthesia, for anaesthesia of forearm and hand. He described a new method of producing analgesia of limb which he named 'vein anaesthesia'. August bier first presented his new method of intravenous regional anaesthesia at the 37th congress of the Gerrman surgical society on 22nd April 1908. His method, which now bears his name, consisted of occluding the circulation in a segment of the arm with two bandages and injecting dilute local anaesthesia through a venous cut down in this isolated segment,

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which resulted in prompt analgesia (Bier, 1908)[1]. The earliest agent injected was prilocaiine, 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 (Holmes, 1963)[2] Lidocaine remains the standard local anaesthesia agent for surgical procedures in north America (Henderson *et al*., 1997)[3] and prilocaine is used widely in Europe (Bader *et al*.,1988)[4] intravenous regional anesthesia is easy to administer, reliable and cost-effective, Major nerve blocks such as brachial block and femorall-scieatic block requretechincal expertise. Conversely, the administration of intravenous regional anesthesia require only the skill necessary to perform a veni-puncture (brown *et al*., 1989)[5]. The ideal intravenous regional anaesthesia solution should have the following features: rapid onset reduced tourniquest pain and prolonged post-deflation analgesia, local anaesthestics alone are not albe to bestow all such attributes to the IVRA solutions; hence a mulittude of adjuncts like opioids, tramadol, nonsteriodal anti-inflammatory druge, clonidine, Dexmedetomidine, muscle relaxants, potassium magnesium, ketamine and alkaliniswation with sodium bicarbonate have been used to improve the overal quality of anaesthesia and analgesia (choyce and peng 2002; turan *et al*., 2002)[6,7].Dexmedetomidine, an imidazole compound, is the pharmacologically active dextroisomer of medetomidine. It is a potent alpha-2 adrenoceptor agonist with eight times higher affinity for the alpha-2 adrenoceptor than clonidine (Bhana N *et al*.,2000)[8] Alpha-2 agonists produce sedation, analgesia, hypnosis, anxiolysis and sympatholysis (Miller 7th edition; p.751).Perioperative administration of Dexmedetomidine decrease the requirement for opioid or non-opiod analgesics both intra-and postoperatively (Jaakola ML *et al*., 1993)[9]. Aho and colleagues concluded that intravenously administered Dexmedetomidine relieved pain and reduced opioid requirement after laparoscopic tubai ligation. However, patients who received Dexmedetomidine were more sedated than other patients in the study (AhoMs *et al*., 1991)[10].Jaakola and colleagues demonstrated the analgesic efficacy of Dexmedetomidine in human touniquet pain in their study (Jaakola ML *et al*., 1991).The quality of intraoperative anaesthesia, shortens the onset of motor and sensory block, decniquest pain and improves post-operative analgesia without any significant side-effects (Memis D *et al* ., 2004. ) however, esmaoglu and associates oberved that addition of 1 ug/kg of Dexmedetomidine to lidocaie for intravenous regional anaesthesia improves the quality of anaesthesia and decrease analgesic requirements. But has no effects on the sensory and motor block onset times (Esmaoglu A *et al*., 2005)

## AIMS AND OBJECTIVES

To evaluate the anaesthetic and analgesic effectiveness of Dexmedetomidine and acetaminophen when administered as adjuncts to lidocaine in intravenous regional anaesthesia to find out sensory and motor block onset times.

## METHODOLOGY

After obtaining approval from hospital ethical committee, the study was conducted in Government Medical College, Jammu in the department of anaesthesiology and intensive care 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 I hour duration. History of drug allergy, Patients with sickle cell anemia, Patients with bleeding and coagulation disorders, Patients with liver disorders, Patients with raynaud, s disease, scleroderma, myasthenia gravis, renal insufficiency, history of convulsions ,Pregnancy and lactation were excluded from the study. The patients were divided randomly into three group of 30 patients each. Patients were divided into 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 0.5 ug/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 data was analysed 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. A ‘p’ value of <0.05 was considered statistically significant. Qualitative variable was analyzed using chi-square test. All analysis was conducted in accordance to intention to treat principle.

## RESULTS

**Table 1:** Onset of sensory block (minutes)

| | Onset of sensory block (minutes) | | |
|---|---|---|---|
| | mean | ±SD | Range |
| Group I | 5.20 | 1.08 | 3-7 |
| Group II | 1.66 | 0.55 | 1-3 |
| Group III | 4.53 | 1.23 | 2-7 |

F= 105.1p-value =0.0001(HS)

From Table 1: In group I, mean onset of sensory block was 5.20 ± 1.08 minutes. In group II, mean onset of

sensory block was 1.66 ± 0.55 minutes. In group III, means onset of sensory block was 4.53 ± 1.23 minutes. Using ANOVA, there was statistically significant among all the three groups (p<0.05).

**Table 2:** Onset of motor block (minutes)

| | Onset of motor block (minutes) | | |
|---|---|---|---|
| | Mean | ± SD | Range |
| Group I | 9.68 | 1.72 | 705-15 |
| Group II | 5.45 | 1.85 | 3.5-10 |
| Group III | 9.51 | 1.83 | 7.14 |

F=52.79, P=value = 0.0001(HS)

From Table 2:In group I, mean onset of motor block was 9.68 ± 1.72 minutes. In group II. Mean onset of motor block was 5.45 ± 1.85 minutes. In group III, mean onset of motor block was 9.51 ± 2.83 minutes. Using ANOVA, there was statistically significant difference among all the three groups (p<0.05).

**Table 3:** Quality of anesthesia (no. and % of patients)

| | Quality of anesthesia (no.of patients) | | | | | |
|---|---|---|---|---|---|---|
| | Excellent | | Good | | Moderate | |
| | n | % | n | % | n | % |
| Group I | 10 | 33.3% | 15 | 50% | 5 | 16.6% |
| Group II | 28 | 93.3% | 2 | 6.6% | 0 | 0% |
| Group III | 20 | 66.6% | 10 | 33.3% | 0 | 0% |

$X^2$=27.96, p-value<0.0001 (highly significant) among all the three groups

Excellence Quality of anesthesia was significantly higher in Group II as compared other groups.

**Table 4:** Intra-Operative Analgesia by Visual Analogue Scale (0.10 Cm) At 10, 20, 30, 40, 50, 60 Minutes

| | VAS at 10 minutes (Mean±SD) | | Vas at 20 minutes(Mean± D) | | VAS at 30 minutes(Mean±S) | | Vas at 40 minutes(Mean±SD | | VAS at 50 minutes(Mean±SD) | | VAS at 60 minutes(Mean±SD) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Group I | 0.56 | 0.50 | 0.93 | 1.11 | 1.56 | 1.40 | 1.23 | 0.72 | 1.53 | 0.57 | 1.90 | 0.48 |
| Group II | 0.13 | 0.34 | 0.20 | 0.40 | 0.30 | 0.46 | 0.56 | 0.50 | 0.73 | 0.52 | 0.00 | 0.52 |
| Group III | 0.33 | 0.47 | 0.26 | 0.46 | 0.40 | 0.49 | 0.66 | 0.47 | 0.10 | 0.75 | 0.30 | 0.65 |
| p-value | F=7.01, p=0.0001(Hs) | | F=9.22 p=0.0001(Hs) | | F=18.26 p=2.83E-07 (Hs) | | F= 16.35 p=0.0001(HS) | | F= 12.29 p=0.0001(HS) | | F= 24.47 p=3.62 (HS) | |

From Table 4.There was significantly lower Visual Analogue Scale in Group II as compared to other groups, among intra-operative analgesia at 10, 20, and 30,40,50,60.

## DISCUSSION

In our study. we used scoring scale given by palecha *et al*, to assess the sensory and motor block onset time. (palecha s *et al*. 2001)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, reslpectively. Statistically the differnce was found to be significant amongst all the group using ANOVA (p-<0.05). in the intergoup comparison, between group I and II, it was observed that the sensory and motor onset time gets significantly shortened in bonferroni's t-test) in astudy by memis *et al* (2004), the mean time of onset of sensory and motor block was 5±2 minutes and 10±4 minutes respectively, when 0.5 ug/kg Dexmedetomidine was added to 40 ml of 0.5% lidocaine in IVRA, and they observed that the sensory and motor block onset time gets significantly shortened in Dexmedetomidine group as compared to control group(p<0.05).however, in study by esmaoglu *et al* (2005), statistically the onset time for sensory and motor block in Dexmedetomidine group (4.8±2.0min. and 11.2±4.6min) was found to be similar as in control group (p<0.05),although they used the dose of 1 ug/kg of Dexmedetomidine in 40ml of 0.05% lidocaine in ivra . Our finding are comparable to the study by Memis *et al*[11], but differes from the study by Esmaoglu *et al*[12].In the intergroup comparison, between II and III, we observed that there was statistically significant difference in the sensory and motor block onset time between Dexmedetomidine and acetaminophen group (p<0.05Using bonferroni's t-test).Thus, Dexmedetomidine provides earlier onset of sensory and motor block as compared to acetaminophen. This could be because of enhancement of local anaethetic action of lidocain. by Dexmedetomidine Yoshitomi *et al*.(2008)[13], and not by acetaminophen. The change in the ph of injected solutions, due to adjuvants, added to lidocaine, can also affects the onset of block, which was however, not tested in our study. Quality of anaesthesia score was assessed on numeric scale as-excellent (4): no complaint from patrint; good (3): minor complaint with no need of supplemental analgesics; moderate (2): complaint which required supplemental analgesics unsuccessful (1): patient given general anaesthesia (Esmaoglu *et al*, 2005) In group II, 28(93.3%) patients had excellent quality of anaesthesia score, 2(6.6%) had good quality of anaesthesia score. [range (3-4)]In group III, 20(66.6%) patients had excellent quality of anaethesia score, 15(50%) had good

quality of anaesthesia score, and 5 (16.6%) had moderate quality of anaesthesia score [range (2-4)].In group II and III, no patient had moderate score. In the intergroup comparison between group I andII, since more number of patients in Dexmedetomidine group had excellent score as compared to control group, Dexmedetomidine provides better quality of anaesthesia than control group. Memic *et al* (2004), also observed excellent quality of anaesthesia score[range (3-4)] in Dexmedetomidine group and good[range (2-3)] in control group and difference was statastically significant ($p<0.05$). In the intergroup compare between group I and II, since more number of patients in acetaminophen group had excellent score as compared to control group. Acetaminophen provides better quality of anaesthesia than control group.Sen *et al*(2009)[14], observed that anaesthesiaquality was excellent [range (2-4)] in acetaminophen group and good ($p<0.05$). our finding are 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 anaesthesia than acetaminophen. Intraoperative analgesia was assessed by visual analogue scale of 0-10 [o=no pain, 10=worst pain].At 10 minutes, the difference in vas was statistically significant between group I and II with lower vas in group II ($P<0.05$ using bonferroni's t-test) there was statistically insignificant between group I and III , and group II and III ($p>0.05$).At 20 minutes, the difference in vas was statistically significant between group I and II and group I and III with lower vas in group II and III. ($p<0.001$ using bonferroni's t-test). There was statistically insignificant difference between group II and III ($p>0.05$). similarly at 30,40,50and60 minutes, there was statistically significant difference in vas between grpup I and II, and group I andIII ($p<0.001$) and insignificant between II and III ($p>0.05$).Statistically there was significantly lower vas in group II at 10, 20,30,40,50 and 60minutes when compared to control group ($p<0.001$ using) Bonferroni's t-test) in the study by memis *et al* (2004), there was statistically significant difference in vas scroe at 5,10,15,20 and 40 minutes after tourniquet inflation. There was statistically highly significant lower vas in Dexmedetomidine group ( p-value <0.001)as compared to control group. Esmaoglu *et al* (2005)[12], also observed significantly lower vas score in the Dexmedetomidine group with lesser requirement of intraoperative analgesics as compared to control group ($p<0.05$). Our results are comparable to these studies. Sato j *et al*, (1991)[15] 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, Significantly lower vas score was observed in Dexmedetomidine group as compared to control group. In our studyHowever, we observed lower vas score in acetaminophen group as compared to control group in the intraoperative perior. Canbay *et al* (2008)[16] reported that acetaminophen pretreatment appears to be effective in reducing the pain experienced durimngiv injection of propofol. This suggests the peripheral antinociceptive effects of acetaminophen. Deciga-c *et al*, (2004)[17] reported that which are more resistant to lidocaine than A-delta fibres, 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.

## CONCLUSION

Itis concluded that the addition of dexmedetomidine or acetaminophen to lidocaine in intravenous regional anaesthesia definitely improve the quality of anaesthesia and analgeisa to a variable extent. However, dexmedetomidine is more potent, and provides better quality of anaesthesia and analgesia, and prolongs the duration of postoperative analgesia more than acetaminophen.

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