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**Original research article**

# Comparative Evaluation of Dexmedetomidine and Clonidine as Adjuvants in Epidural Anaesthesia

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**Abstract**

**Background:** Efforts to find a better adjuvant in regional anaesthesia are underway since long. Sedation, stable haemodynamics and an ability to provide smooth and prolonged post- operative analgesia are the main desirable qualities of an adjuvant in neuraxial anaesthesia.[1]

Epidural administration of α-2 adrenergic agonist is associated with sedation, analgesia, anxiolysis, hypnosis and sympatholysis. Clonidine has been used successfully over the last decade for the said purpose and the introduction of dexmedetomidine has further widened the scope of α-2 agonists in regional anaesthesia.

**Material and Methods:** A prospective randomized double blind controlled study was planned. 60 patients of ASA I & II physical status aged between 18-60 yrs who underwent elective infraumbilical and lower limb surgical surgery. inclusion criteria were enrolled in the study and were randomly allocated into two groups. Group A (n=30) = patients received 0.5% isobaric bupivacaine 15 ml with dexmedetomidine 1µg/kg. Group B (n=30) = patients received 0.5% isobaric bupivacaine 15ml with clonidine 2µg/kg.

**Conclusion:** Dexmedetomidine is a better adjuvant than clonidine in epidural anaesthesia because of better sedation, anxiolysis, superior intraoperative and postoperative analgesiaand stable cardio- respiratory parameters.

**Keywords:** Bupivacaine, Dexmedetomidine, Clonidine, epidural.

## Introduction

Epidural blockade is becoming one of the most useful and versatile proceduresin modern anesthesiology. It is unique in that it can be placed at virtually any level of the spine, allowing more flexibility in its application to clinical practice. It is more versatile than spinal anaesthesia, giving the clinician the opportunity to provide anaesthesia and analgesia, as well as enabling chronic pain management. It can be used to supplement general anaesthesia, decreasing the need for deep levels of generalanaesthesia, therefore providing a more haemodynamically stable operative course. It provides better postoperative pain control and more rapid recovery from surgery. For orthopedic surgery, the provision of pain relief enables early post operative mobilization, accelerates rehabilitation and return to normal function.[3] Surgical methods and the anaesthetic techniques have evolved and improved drastically over the last two decades. Many techniques and drug regimens, with partial or greater success, have been tried from time to time to calm the patients and to eliminate the anxiety component during regional anaesthesia. Bupivacaine is a long acting amide local anaesthetic which has been in use for more than 40 years. Its introduction in 1957 is a very important step in the evolutionof regional anaesthesia. It is commercially available as a racemic mixture containing equal proportions of the S(-) and R(+) isomers. It is widely used for subarachnoid block, epidural block, caudal block, nerve

blocks, infiltration, post operative analgesiaand labor analgesia[12]. α-2 adrenergic agonists have both analgesic and sedative properties when used as an adjuvant in regional anaesthesia[13]. Dexmedetomidine is a highly selective α2Adrenergic agonist with an affinity of eight times greater than clonidine. The anaesthetic and the analgesic requirement get reduced to a huge extent by the use of these two adjuvants because of their analgesic properties and augmentation of local anaesthetic effects as they cause hyperpolarisation of nerve tissues by altering transmembrane potential and ion conductance at locus coeruleus in the brainstem. The stable haemodynamics and the decreased oxygen demand due to enhanced sympathoadrenal stability make them very useful pharmacologic agents Keeping their pharmacologic interactions and other properties we planned a double blind prospective randomized clinically controlled study at our institute with an aim to compare the analgesic and sedative effects of both these drugs when used epidurally as an adjuvant to Bupivacaine in patients undergoing lower abdominal and lower limb surgeries. Very limited literature is available on the use of dexmedetomidine and clonidine as an adjuvant drug with bupivacaine in epidural analgesia. This study appears to be the first comparing these drugs in epidural analgesia.

**Objectives**

The purpose of this study was to compare the clinical profile of two alpha 2 agonists dexmedetomidine and clonidine when administered epidurally.

To compare the ability to provide smooth intraoperative and postoperativeanalgesia. To compare the sensory and motor block levels. To compare the ability to provide sedation.

**Review of Literature**

Bajwa S J et .al conducted a prospective randomized study on 50 adult female patients between the ages of 44 and 65 years of ASAI/II grade who underwent vaginal hysterectomies. The patients were randomly allocated into two groups; ropivacaine + dexmedetomidine (RD) and ropivacaine + clonidine (RC), comprising of 25 patients each. Group RD was administered 17 ml of 0.75% epidural ropivacaine and 1.5 μg/kg of dexmedetomidine, while group RC received admixture of 17 ml of 0.75% ropivacaine and 2 μg/kg of clonidine. Dexmedetomidine is a better neuraxial adjuvantcompared to clonidine for providing early onset of sensory analgesia, adequate sedation and a prolonged post-operative analgesia. A prospective double-blind randomised study w**as** conducted **by** Babu M S, Verma A K, Agarwal A , Tyagi MSC ,Upadhyay M, Tripathi S on 60 subjects, 33 were men and 27 were women between the age of 18 and 65 years of American Society of Anaesthesiologists (ASA) I/II class who underwent spine surgeries. They were randomly allocated into two groups, ropivacaine + dexmedetomidine (RD) and ropivacaine + clonidine (RC), comprising 30 patients each. Group RD received 20 ml of 0.2% ropivacaine and 1 μg/kg of dexmedetomidine while group RC received 20 ml of 0.2% ropivacaine and 2 μg/kg of clonidine through the epidural catheter. The demographic profile and ASA class were comparable between the groups. A prospective randomised study was conducted by Jain A, Gupta V , Sehgal C,Kumar R on 120 ASA status I and II patients of either sex, aged 21 years to 60 years, undergoing elective infraumbilical and lower limb surgery. . The subjects were randomly divided into three groups: Group I Patient were given plain bupivacaine (0.5%) , Group II Patient in this group were given 0.5% bupivacaine with clonidine in the dose of 1mg/kg body weight. Group III Patient in this group were given 0.5% bupivacaine with clonidine in the dose of 2mg/kg body weight **.** Results showed latency of sensory block as judged by loss of pin prick sensation was 16.63 ± 3.08, 14.81 ± 2.32, 11.13 ± 2.08 min in Group I, Group II and GroupIII respectively. Percentage of patient with Grade III blockade was 40%, 67.5%, 77% in in Group I, Group II and Group III

respectively. Mean duration ofanalgesia was 2.8 ± 0.43, 4.7 ± 0.56, 5.1 ± 0.69 in Group I, Group II and GroupIII respectively.

A prospective double-blind randomised study w**as** conducted by Hanoura S E, Hassanin R, Singh R to evaluate the effect of adding dexmedetomidine to regular mixture of epidural drugs for pregnant women undergoing elective caesarean section with special emphasis on their sedative properties, ability to improve quality of intraoperative, postoperative analgesia, and neonatal outcome on fifty women of ASA physical status I or II at term pregnancy. A prospective double-blind randomised study was conducted by Chand T, Kumar V, Joshi K to compare the analgesic efficacy and the safety profile of clonidine and fentanyl as an adjuvant to bupivacaine for postoperative lumbar epidural analgesia on 46 patients of ASA-I-II aged 40-55 years who underwent vaginal hysterectomy. They were randomly allocated in two groups to receive 10ml of 0.125% bupivacaine with 50μg clonidine or 10ml of 0.125% bupivacaine with 50 μg fentanyl for postoperative epidural analgesia.

**Material and Methods**

A prospective randomized double blind controlled study was planned. 60 patients of ASA I & II physical status aged between 18-60 yrs who underwent infraumbilical and lower limb elective surgery and satisfying all the inclusion criteria were enrolled in the study and were randomly allocated into two groups. A (n=30)=patients received 0.5% isobaric bupivacaine 15 ml with dexmedetomidine 1μg/kg. Group B (n=30) = patients received 0.5% isobaric bupivacaine 15ml with clonidine 2μg/kg. Adult patients (18- 60yrs) of physical status ASA I & II who underwent elective lower limb surgical procedures under epidural anaesthesia.

***Inclusion criteria***

ASA grade I & II status.
18-60 years of age.
Patients giving informed written consent.
Patients scheduled to undergo elective below umbilical and lower limbsurgical procedures under epidural anaesthesia.

***Exclusion criteria***

ASA III or greater. Age more than 60 years and less than 18 years.
Pregnant and lactating women. Any contraindication to epidural anaesthesia uncooperative patients, hypotension, previous spinal surgeries, spine abnormalities, local site infectionand coagulation abnormalities.

A prospective randomized double blind study was planned. The study solutions were prepared by an anaesthesiologist not involved in the patients care. Patient and anaesthesiologist who deliver the epidural anaesthesia were blinded by the study solutions.

**Observation**

**Table 1: DISTRIBUTION OF PATIENTS ACCORDING TO AGE GROUPSIN GROUP A AND GROUP B**

| Age groups | Group A | % | Group B | % | Total | % |
|---|---|---|---|---|---|---|
| **20-29yrs** | 12 | 40.00 | 13 | 43.33 | 25 | 41.67 |
| **30-39yrs** | 6 | 20.00 | 9 | 30.00 | 15 | 25.00 |
| **40-49yrs** | 9 | 30.00 | 5 | 16.67 | 14 | 23.33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **50+yrs** | 3 | 10.00 | 3 | 10.00 | 6 | 10.00 |
| **Total** | 30 | 100.00 | 30 | 100.00 | 60 | 100.00 |
| **Mean age** | 35.17 | | 33.87 | | 34.52 | |
| **SD age** | 11.15 | | 9.38 | | 10.24 | |
| **Chi-square= 3.4073 df=3 p=0.3330** | | | | | | |

The mean age in group A is 35.17±11.15 years and in group B is 33.87 ± 9.38 years.Age incidence between the two groups is comparable. (P>0.05)

**Table 2: COMPARISON OF GROUP A AND GROUP B WITH RESPECTTO TOTAL DURATION OF SURGERY (IN MIN) BY T TEST.**

| Group | Mean | SD | t-value | P-value |
|---|---|---|---|---|
| **Group A** | 111.83 | 23.58 | -0.1595 | 0.8739 |
| **Group B** | 112.67 | 16.23 | | |

The mean duration in group A is 111.8±23.6 min and in group B is 112.7±16.2 min. Statistical analysis using students unpaired t test shows that there is no statistically significant difference between the groups. (t=0.17, P>0.05)

**Results**

The demographic profiles of the patients in both the groups with regards to age, weight and body mass index , distribution as per ASA status and mean duration of surgery was comparable in both the groups and statistically non significant (*P* > 0.05)

**Table 3:**

| DEMOGRPHIC VARIABLES | GROUP A | GROUP B | P VALUE |
|---|---|---|---|
| **Female /male** | 12/18 | 13/17 | 0.7934 |
| **Age in years** | 35.17 | 33.87 | 0.3330 |
| **Weight in kg** | 56.73 | 58.93 | 0.2841 |
| **Height in cm** | 164.33 | 165.30 | 0.2887 |
| **BMI** | 21.02 | 20.83 | 0.8426 |
| **ASA I/II** | 26/4 | 27/3 | 0.6875 |
| **Mean duration of surgery in min** | 111.83 | 112.67 | 0.8739 |

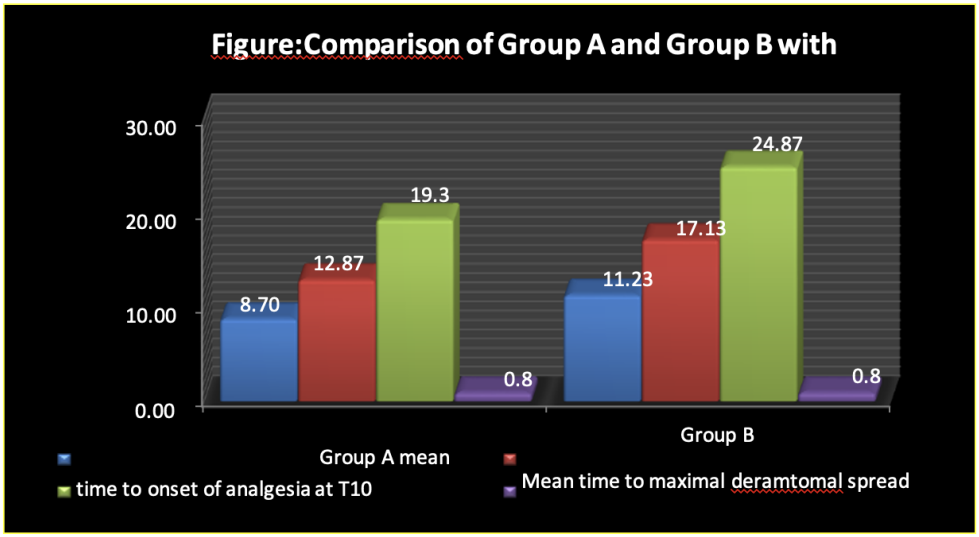
Addition of dexmedetomidine to bupivacaine as an adjuvant resulted in an earlier onset (8.70 ± 1.12 min) of sensory analgesia at T10 as compared to the addition of clonidine (11.23 ± 1.38min). Dexmedetomidine not only provided a higher dermatomal spread but also helped in achieving the maximum sensory anaesthetic level in a shorter period (12.87 ± 1.04 min) compared to clonidine (17.13 ± 1.55 min).Modified Bromage scale 3 was achieved earlier (19.30 ± 1.62 min) in patients who were administered dexmedetomidine as adjuvant compared to clonidine (24.87±1.55).All these initial block characteristics turned out to be statistically significant values oncomparison (*P* < 0.05), statistically significant values on comparison of post- operative block characteristics among the two groups. Dexmedetomidine provided a smooth and prolonged post-operative analgesia as compared

**INITIAL BLOCK CHARACTERISTICS**

**Table 4:**

| Variables | Group | Mean | SD | t-value | P-value |
|---|---|---|---|---|---|
| **onset time of sensory block at T10** | **Group A** | **8.70** | **1.12** | **-7.8045** | **0.00001*** |

| | | | | | |
|---|---|---|---|---|---|
| | **Group B** | **11.23** | **1.38** | | |
| **Time to maximum sensory block** | **Group A** | **12.87** | **1.04** | **-12.5265** | **0.00001*** |
| | **Group B** | **17.13** | **1.55** | | |
| **Time in min for bromage 3** | **Group A** | **19.30** | **1.62** | **-13.5996** | **0.00001*** |
| | **Group B** | **24.87** | **1.55** | | |
| **Mephenteramine requirement (in mg)** | **Group A** | **0.80** | **1.75** | **0.0000** | **1.0000** |
| | **Group B** | **0.80** | **1.92** | | |
| | | | | | |




To clonidine. The evidence was very much visible in the prolonged time to two segmental dermatomal regression (136.00 ± 6.86 min) compared to clonidine group( 124.97±6.65) as well as return of motor power to Bromage 1 (240.93 ±16.54 min) compared to clonidine group ( 160±27.58). As a result the time for rescue analgesia was comparatively shorter (342.97 ± 18.03 min) in the patients who were administered clonidine (302.97± 22.54) min ($P < 0.05$). Mean time taken to sensory regression to S1 was longer in dexmedetomidine group (314.17 ±18.87) compared to clonidine group (298.73±20.68

**Discussion**

Epidural anaesthesia and analgesia is considered by many as the gold standardtechnique for major surgery. It has the potential to provide complete analgesia for aslong as the epidural is continued. Epidural techniques are particularly effective atproviding dynamic analgesia, allowing the patient to mobilize and resume normalactivities unlimited by pain. It also improves the postoperative outcome andattenuates the physiologic response to surgery, in particular, significant reduction inpulmonary infections, pulmonary embolism, ileus, acute renal failure and blood loss. Bupivacaine is a well established long acting amide local anaesthetic which has been in use since 1957. It has been the most popular and widely used local anaesthetic agent suitable for long surgical procedures. It is used to provide intraoperative anaesthesia by intrathecal, epidural and caudal routes, nerve blocks, field blocks, labour analgesia, post operative analgesia by continuous thoracic or lumbar epidural infusion and continuous nerve blocks, chronic pain management and others. It provides excellent operating conditions with good muscle relaxation. The use of neuraxial opioids is associated with quite a few side effects, so various options including α-2 agonists are being extensively evaluated as an alternative with emphasis on opioid-related side effects such as respiratory depression,

nausea, urinary retention and pruritis. Clonidine has been used successfully over the last decade for the said purpose and the introduction of dexmedetomidine has further widened the scope of α-2 agonists in regional anaesthesia.The faster onset of action of local anaesthetics, rapid establishment of both sensory and motor blockade, prolonged duration of analgesia into the post-operative period, dose-sparing action of local anaesthetics and stable cardiovascular parameters makes these agents a very effective adjuvant in regional anaesthesia. A prospective randomized double blind controlled study was planned with 60 patients of ASA I & II physical status aged between 18-60 yrs scheduled to undergo infraumbilical and lower limb elective surgery and satisfying all the inclusion criteria were be enrolled in the study. patients were randomly divided into 30 groups each. Group A (n=30) patients received 0.5% isobaric bupivacaine 15 ml with dexmedetomidine 1µg/kg .Group B (n=30) patients received 0.5% isobaric bupivacaine 15ml with clonidine 2µg/kg. All the patients were belonging to the age group of 18-60 years .12 patients in group A and 13 in group B were between 21-30 yrs, 6 in group A and 9 in group B were between 31-40 yrs, 9 in group A and 5 in group B were between 41-50 yrs and 3 in group A and 3 in group B were between 51-60 yrs. The mean age in group A was 35.16 ± 11.15 yrs and in group B was 33.83 ± 9.43 yrs. Age incidences between the groups were comparable. Bajwa S J et.al found that Dexmedetomidine provided a significantly higher dermatomal spread compared to clonidine when added as adjuvant to epidural ropivacaine.Paula F. et.al found that epidural dexmedetomidine did not achieve a upper level of anaesthesia ($p > 0.05$) when compared to ropivacaine alone.Bajwa S J, Bajwa S K, Kaur used ropivacaine 0.75% versus ropivacaine 0.75% with clonidine epidurally for caesarean sections and found no statistical significance in the level of anaesthesia among both groups (T6–T7 level) . Comparison of group A and group B with respect to sedation scores by t test revealed that Sedation scores were statistically significant at 20 min group A (2.87±0.68) groupB (1.30± 0.47 ) ,40 min group A( 2.27± 0.45) group B (1.00±0.00) ,60min group A (1.20±0.41) group B( 1.00±0) in group A compared to group B.In a study done by Bajwa S J et.al**,** mean sedation scores were significantly higher in dexmedetomidine group compared to clonidine group. 36% patients in group RD hada sedation score of 3 as compared 16% in group RC ($P < 0.0001$). Only 16% of the patients in the dexmedetomidine group had sedation scores of 1 compared to 32% wide and awake patients in clonidine group, which was a highly significant statistical entity ($P < 0.0001$). In a study conducted by Paula F et.al the duration of postoperative analgesia was significantly different between groups ($p < 0.05$), and dexmedetomidine group showedanalgesia 33% higher than the control group.In a study done by Bajwa S J , Arora V, Kaur J, Singh A ,Parmar S first rescue top requirement was ( 366.62 ±24.42 min ) in dexmedetomidine group and (242.16± 23.86min)in clonidine group ($p > 0, 05$). In our study the mean baseline SBP was 125.20±13.39 mm Hg in group A and 125.40±12.74 in group B. (Table 15, chart 12) The mean baseline DBP was 80.73±8.4in group A and 79.87±7.1 in group B. (We observed that there was a fall in the systolic and diastolic blood pressure below the baseline after epidural administration at various intervals in both the groups. But this difference was not statistically significant ($p>0.05$). six patients in group A and five patient in group B had clinically significant hypotension (SBP<30% baseline) which was corrected with IV mephentermine bolus. Mephenteramine dose consumption was comparable in both groups. Studies can be done to find the equivalent epidural doses of dexmedetomidine and clonidine. In our study we found 1µg/kg of dexmedetomidine had superior anaesthetic effects compared to 2 µ/kg dose of clonidine. Studies can also be performed with newer local anaesthetics like levobupivacaine and ropivacaine.

## Conclusion

Our results allow us to conclude that addition of dexmedetomidine or clonidine to epidural bupivacaine significantly promoted analgesia in patients undergoing lower limb surgeries

without increasing the incidence of side-effects. Dexmedetomidine is a better neuraxial adjuvant to bupivacaine when compared to clonidine for early onset of analgesia, superior intraoperative analgesia, stable cardio respiratory parameters, prolonged post operative analgesia and providingpatient comfort.

**References**

1. G Edward Morgan, Maged S Mikhail, Michael J Murray. The practice of Anesthesiology. Clinical Anesthesiology. 4th ed. McGrawHill,2008;1-16
2. NJH Davies, JN Cashman. Techniques in regional Anaesthesia. Lee's Synopsis of Anaesthesia. 13th ed. Elsevier,2006;401-70
3. Admir hadzic. Regional Anaesthesia and acute pain management.1st Edn. McGraw- Hill Professional,2006
4. Höhener D, Blumenthal S, Borgeat A. Sedation and regional anaesthesia in the adult patient. Br J Anaesth. 2008; 100:8–16.
5. Helgeson LE. Sedation during regional anaesthesia: Inhalational versus intravenous.Curr Opin Anaesthesiol. 2005; 18:534–9.
6. Nemethy M, Paroli L, Williams-Russo PC, Blanck TJ. Assessing sedation with regional anaesthesia: Inter-rater agreement on a modified Wilson Sedation Scale. Anesth Analg.2002; 94:723–8.
7. Asehnoune K, Albaladejo P, Smail N, Heriche C, Sitbon P, Gueneron JP, et al.
8. Information and anaesthesia: What does the patient desire? Ann Fr AnesthReanim.2000; 19:577–81.
9. Badner NH, Nielson WR, Munk S, Kwiatkowska C, Gelb AW. Preoperative anxiety: Detection and contributing factors. Can J Anaesth. 1990; 37:444–7.
10. Schnider TW, Minto CF. Predictors of onset and offset of drug effect. Eur J Anaesthesiol.2001; 23:26–31.
11. McNamee DA, Parks L, McClelland AM, Scott S, Milligan KR, Ahlén K, et al.
12. Intrathecal ropivacaine for total hip arthroplasty: Double-blind comparative studywith isobaric 7.5mg.ml -1 and 10mg.ml-1 solutions. Br J Anaesth. 2001; 87:743–7.
13. Kamibayashi T, Maze M. Clinical uses of alpha-2 adrenergicagonists. Anaesthesiology.2000; 93:1345–9.
14. D A H de Beer, M L Thomas. Caudal additives in children – solutions or problems?
15. Br J Anaesth 2003;90(4):487-98.
16. Scafati A. Analgesia and alpha agonists 2. Medens Rev. 2004; 4:7.
17. Mauro VA, Brandão ST. Clonidine and dexmedetomidine through epidural route for post-operative analgesia and sedation in a colecistectomy. Rev Bras Anestesiol. 2004; 4:1–10.
18. Gabriel JS, Gordin V. Alpha 2 agonists in regional anaesthesia and analgesia. Curr Opin Anaesthesiol. 2001; 14:751–3.
19. Taittonen MT, Kirvelä OA, Aantaa R, Kanto JH. Effect of clonidine and dexmedetomidine premedication on perioperative oxygen consumption and haemodynamic state. Br J Anaesth. 1997; 78:400–6.
20. Buerkle H. Peripheral anti-nociceptive action of alpha2 -adrenoceptor agonists. Baillièe's Clin Anaesth. 2000; 14:411–8.
21. Bajwa SJ, Bajwa SK, Kaur J, Singh G, Arora V, Gupta S et al. Dexmedetomidine and clonidine in epidural anaesthesia: A comparative evaluation. Indian J Anaesth 2011; 55:116-21.

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