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A Study on Effects of Dexmedetomidine Used as an Adjuvant in Epidural Post-Operative Analgesia

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Abstract

Background: Epidural anaesthesia with adjuvant is normally used for postoperative pain management in infra umbilical surgeries but search for ideal adjuvant without any side effect goes on. Aim: This study was done to assess the onset and duration of sensory and motor block and side effects of dexmedetomidine, when used as an adjuvant in epidural anaesthesia in infra umbilical surgeries. **Subjects and Methods:** 60 patients of ASA status I and II, posted for infra umbilical surgeries were randomly allocated into two groups of 30 each. Group L patients received epidural 0.5% levobupivacaine. Group LD patients received epidural 0.5% levobupivacaine and 1μg/kg dexmedetomidine. Preoperative and postoperative block characteristics as well as hemodynamic parameters and side effects were monitored. **Results:** Dexmedetomidine as an adjuvant had an earlier onset and longer duration of sensory and motor block compared to levobupivacaine alone. Sedation scores were statistically significant with dexmedetomidine group in comparison to levobupivacaine alone group. **Conclusion:** Dexmedetomidine, as an adjuvant to epidural levobupivacaine provided prolonged analgesia in infraumbilical surgeries.

Keywords: Dexmedetomidine, levobupivacaine, infraumbilical surgeries.

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Introduction

Epidural anaesthesia provides both intra and post-operative pain relief in various infraumbilical surgeries. Epidural bupivacaine had been commonly used in the past decades for providing adequate post-op pain relief.[1] The analgesic duration can be prolonged by increasing dose of local anaesthetics; however the risk of systemic cardiac and neurotoxicity can be increased.[2] Therefore, adjuvant can be added to local anaesthetics to prolong the analgesic duration so that the amount of local anaesthetics can be restricted. Recemic bupivacaine is most frequently used long acting local anaesthetic agent in regional anaesthesia. But the low dose bupivacaine is often used in order to reduce cardiovascular side effects which may not provide adequate postoperative analgesia.[3] Levobupivacaine is the isolated S (-) isomer of bupivacaine. Due to lower affinity of S(-) isomer to cardiac sodium channel compared to R isomer, it is less cardio toxic.[4] So we have chosen levobupivacaine as the local anaesthetic as it is longer acting and devoid of any cardiac side effects. Recently, several neuraxial adjuvants, including clonidine, opioids, dexamethasone, ketamine, magnesium sulphate and midazolam have demonstrated the synergistic analgesic effect with local anaesthetics with varying degrees of success. But the search for ideal adjuvant for a particular local anaesthetic agent goes on.[5] Literature is available using α-2 agonists like clonidine as adjuvant to local anaesthetics like bupivacaine, levobupivacaine and ropivacaine in epidural route but very few are there regarding their use with dexmedetomidine. α-2 adrenergic agonists like dexemedetomidine have both analgesic and sedative properties when used as an adjuvant in regional anaesthesia.[6] Dexmedetomidine has an eight-fold greater affinity for α2 adrenergic receptors than clonidine and much less α1 activity. Its higher selectivity for α2A receptors is responsible for the hypnotic and analgesic effects.[7] Previous studies have shown that clonidine and dexemedetomidine improved the quality of block when used as adjuvant with ropivacaine or bupivacaine in epidural block but studies are limited where levobupivacaine is used with dexmedetomidine. This study was designed to compare the analgesic, sedative action and side effects of dexmedetomidine when added to levobupivacaine for epidural analgesia in patients undergoing infraumbilical surgeries.

Subjects and Methods

Ethical committee approval and written informed consent were obtained from 60 ASA status (I / II) patients of age 20-60 years, posted for infra umbilical surgeries. This study was done from Jan 2017 to Jan 2018 in a tertiary care

hospital. Patients with history of cardiac, respiratory, hepatic, neurological diseases and with allergy to the study drugs, were excluded from the study. ECG, pulse-oximetry (SPO2) and non-invasive blood pressure (NIBP) were monitored. Epidural anaesthesia was given in the sitting position, using 18 gauge tuohy epidural needles at L3-L4 space and epidural catheter was advanced 4 cm into the epidural space. A test dose of 3 ml of 2% lignocaine solution containing adrenaline 1: 200,000 was injected. After 4-6 min of injecting the test dose and excluding intravascular or subarachnoid injection study drug was injected. Patients were allocated into two groups in double blinded fashion. Group L received 17 ml levobupivacaine with 1ml normal saline and group LD received 17 ml of 0.5% levobupivacaine and 1µg/kg dexmedetomidine (diluted to 1ml) through epidural catheter. The study drugs were prepared by an anaesthetist who was blind about the study. Sensory block was assessed using the blunt end of a 27-gauge needle. All durations were calculated from the time of epidural injection. The two groups were monitored pre and intra operatively for heart rate, non-invasive blood pressure and O2 saturation (SpO2). Intra operative nausea, vomiting, pruritus, sedation or any other side effects were recorded. Sedation was assessed by Ramsay sedation score (1: alert and awake, 2: arousable to verbal command, 3: arousable with gentle tactile stimulation, 4: arousable with vigorous shaking. 5: unarousable). Statistical Methods Data were presented as mean ± SD. t-test was used to compare the two groups for quantitative data and chi-square test was used for qualitative data by SPSS V18. Value of $p<0.05$ was considered statistically significant.

Results

A total of 60 patients posted for infra umbilical surgeries were enrolled for the study. They were randomly divided into two groups. The demographic profiles of the patients in both the groups were comparable with regards to age, sex, height, and weight and body mass index. The ASA status of patients was similar in both the groups and mean duration of surgery was comparable in both the groups ($p>0.05$) [Table 1]. Onset of sensory block at T 10 level was earlier in group LD (6.98±2.51min) compared to the group L (8.34±2.95min). Higher dermatomal spread (T6-7) was seen in group LD in comparison to group L (T7- 8). Time for maximum sensory level was shorter (11.32±4.46min) in group LD compared to group L (14.18±5.2min). All the above sensory block characteristics were statistically significant in group LD in comparison to group L except maximum sensory block level. Complete motor block was achieved earlier (14.75±6.24min) in group LD and 18.52±5.85min in group L which was statistically significant. ($p<0.05$). [Table 2]. Many previous studies had shown that dexmedetomidine can be used as intraoperative sedative agent. In our study mean sedation scores were significantly higher in group LD compared to group L which is statistically significant. [Table 3]. Mean time to 2 segmental dermatomal regression was 155.42±9.54min and 138.10±8.15min in group LD and group L respectively. Return of motor power to bromage 1 was 258.35±27.82min in L group and 285.27±26.29min in group LD. Both the block characteristics were statistically significant. The time for rescue analgesia was 325.94±22.58min in the group L and 354.58±26.1min in group LD which was statistically significant. ($P<0.05$). [Table 4]. Parameters like heart rate, mean arterial pressure, spo2 and respiratory rate were stable and more or less similar in both the groups throughout the study period. [Table 5] showed the comparative incidence of various side effects in both the groups which were statistically not significant. We did not observe respiratory depression in any patient in both the group.

Table 1: Demographic profile of patients of both group.

Demographic characteristics	L group (n=30) Mean + SD	LD group (n=30) Mean + SD	P-value
Age (yrs)	48.2 + 11.5	47.2 + 10.8	0.34
Sex (m:f)	15:15	14:16	0.56
Weight (kg)	64.22 + 12.32	64.45 + 11.48	0.46
Height (cm)	154.8 + 9.58	153.35 + 9.8	0.34
BMI (kg/m2)	26.4 + 2.15	27.1 + 2.52	0.67
ASA (I/II)	28/2	27/3	1.0
Mean duration of surgery (min)	95.12 + 14.5	94.55 + 14.84	0.69

Table 2: Comparison of preoperative block characteristics

Block characteristics	L group (n=30)	LD group(n=30)	P Value
Onset time of sensory block at T 10(mins)	8.34±2.95	6.98±2.51	0.002
Max sensory block level	T7-T8	T6-T7	0.85
Time to max sensory block (mins)	14.18±5.2	11.32±4.46	0.001
Time for complete motor block (mins)	18.52±5.85	14.75±6.24	0.01
Total ephedrine requirement (mg)	7.90±2.5	5.95±2.8	0.12

Table 3: Sedation score in both group

Sedation score	L group (n=30)	LD group (n=30)	P value
1	20	7	0.03
2	7	12	0.04
3	3	11	0.04
4	0	0	0
5	0	0	0

Table 4: Comparisons of post op block characteristics

Post op block characteristics	L group (n=30)	LD group(n=30)	P Value
Mean time to two segment regression (mins)	138.10±8.15	155.42±9.54	0.0002
Mean time to sensory regression at S 1(mins)	295.35±32.24	342.12±33.15	0.0001
Mean time to regression to bromage 1(mins)	258.35±27.82	285.27±26.29	0.0001
Time to first rescue analgesia (mins)	325.94±22.58	354.58±26.1	0.0001

Table 5: Comparison of side effects in intra and postoperative period.

Side effect	L group (n=30)	LD group(n=30)
Nausea	6	4
Vomiting	1	3
Shivering	4	3
Headache	0	2
Dizziness	0	0
Dry month	2	3
Repiratory depression	0	0

Discussion

Adjuvants are used with local anaesthetics in the epidural anaesthesia to prolong postoperative analgesia. Primary aim of this adjuvant is to fasten and prolong the sensory and motor block without any side effect. The pharmacologic properties of α-2 agonists like clonidine and dexmedetomidine have been used extensively in regional blocks. Epidural administration of these drugs is associated with sedation, analgesia, anxiolysis, hypnosis and sympatholysis.[9] Clonidine has been used as adjuvant to local anaesthetics successfully over the last few decades but it has its own side effects. About use of clonidine. The faster onset of action, and prolonged duration of analgesia in the postoperative period, makes it a very effective adjuvant to local anaesthetics in regional anaesthesia. In our study, dexmedetomidine was used as adjuvant to levobupivacaine in epidural anaesthesia in which levobupivacaine – dexmedetomidine combine produced earlier onset of epidural block, prolonged duration of sensory block and more sedation in comparison to levobupivacaine alone. There was no statistical difference in haemodynamic parameters in both groups. Disma et al in their study found that clonidine produced a local anaesthetic sparing effect with a dose dependent decrease in ED50 of levobupivacaine for caudal anaesthesia. In addition, there was a dose dependent prolongation of postoperative analgesia following lower abdominal surgery in children. A dose of 2 μg kg of clonidine provided the optimum balance between improved analgesia and minimal side effects.[10] Wallet et al in their study found that the addition of clonidine to epidural levobupivacaine and sufentanil for patient controlled epidural analgesia in labour improved analgesia, reduced the supplementation rate and reduced pruritus.[11] Milligan et al opined that, in patients undergoing total hip replacement, the addition of the alpha (2)-adrenergic agonist clonidine to epidural infusions of levobupivacaine significantly improved postoperative analgesia.[12] Akin et al in their study found that caudal clonidine prolonged the duration of analgesia produced by caudal levobupivacaine without causing significant side effects Mahran et al,[13] opined that both clonidine and fentanyl can be used as effective additive to epidural levobupivacaine for postoperative analgesia after radical cystectomy with no significant difference between them.[14] Manal et al in a comparative study of epidural morphine and epidural dexmedetomidine used as adjuvant to levobupivacaine, found that dexmedetomidine was a good alternative to morphine as an adjuvant to levobupivacaine in epidural anaesthesia for major abdominal surgeries.[15] Zeng XZ et al in their study found that low-dose epidural dexmedetomidine improved thoracic epidural anaesthesia for nephrectomy. Sensory and motor blockade duration was longer in the dexemedetomidine group than in the control group. Pain score and analgesic requirement was lower in dexemedetomidine group.[16] Ahmed Sobhy Basuni et al used dexmedetomidine as adjuvant to low-dose levobupivacaine in spinal anaesthesia for knee arthroscopy. They opined that dexmedetomidine was a good alternative to fentanyl for supplementation with low-dose levobupivacaine.[17] Aliye Esmaoglu et al concluded that intrathecal dexmedetomidine when added to levobupivacaine for spinal anaesthesia shortens sensory and motor block onset time and prolongs block duration without any significant adverse effects.[18] Our study found Introduction of dexmedetomidine has raised question similar findings using dexmedetomidine as adjuvant to epidural levobupivacaine. El-Hennawy et al studied the effect by adding clonidine or dexmedetomidine to bupivacaine in caudal block in children. They found that addition of dexmedetomidine or clonidine to caudal bupivacaine significantly plolonged analgesia in children undergoing lower abdominal surgeries with no significant advantage of dexmedetomidine over clonidine.[19] Al-Mustafa et al. used dexmedetomidine as an intrathecal adjuvant to bupivcaine and found that its use accelerated the onset of sensory block to reach T10 dermatome.[20] Bajwa et al showed in their study that dexmedetomidine was a better adjuvant than clonidine in epidural ropivacaine anesthesia in providing better intra-operative and postoperative analgesia.[21] Wu H-H et al in a retrospective study opined that neuraxial dexmedetomidine was a favorable adjuvant to local anaesthetics which provides prolonged analgesia. Neuraxial dexmedetomidine was associated with good sedation scores and lower analgesic requirements and stable intra operative hemodynamic.[22] All the above studies showed that dexmedetomidine was a potent adjuvant to levobupivacaine in epidural anaesthesia. It provided earlier onset and prolonged sensory block. Patient comfort, satisfaction and anxiolysis was better when dexmedetomidine was used as adjuvant to levobupivacaine in epidural anaesthesia.

Conclusion

Dexmedetomidine when used as an adjuvant to epidural levobupivacaine provided prolonged sensory and motor block without any significant side effects. Epidural dexmedetomidine with levobupivacaine provided prolonged analgesia and delayed the requirement of 1st rescue analgesia compared to levobupivacaine alone.

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