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Original Research Article.

Comparative Evaluation of the Efficacy and Safety of Fentanyl and Dexmedetomidine as Adjuvants to Levobupivacaine in Epidural Anaesthesia in Patients Undergoing Hip and Lower Limb Surgeries

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ABSTRACT

Introduction: Epidural anaesthesia is a central neuraxial block with many applications ranging from analgesia with minimal motor block to dense anaesthesia with full motor block. The present study was aimed to compare the haemodynamic, sedative and analgesia potentiating effects of dexmedetomidine versus fentanyl as adjuvants to 0.5% Levobupivacaine in epidural anaesthesia in patients undergoing hip or lower limb surgeries.

Methods: 90 patients of either sex ranging in the age group between 18 to 60 years belonging to ASA grade I & II, scheduled for hip and lower limb surgeries were selected. Patients were randomly allocated into three groups of 30 each. Group L was the control group and patients in this group received epidural levobupivacaine (0.5%) 19 ml + Saline (0.9%) 1ml, patiens in group LD received epidural levobupivacaine (0.5%) 19ml + Dexmedetomidine (50µg) 1ml and patients in group LF received epidural levobupivacaine (0.5%) 19ml + fentanyl (50µg) 1ml. Patients were evaluated for sensory and motor characteristics of the block (onset and duration), sedation, duration of analgesia and side effects.

Results: It was observed that onset of sensory block was faster in LD group as compared to Group LF and Group L. The highest level of Sensory block obtained was T5-T6 in 83.33% patients of LD group,T7-T8 in 63.33% patients in LF group and T9 - T10 in 43-33 % patients in L group. Mean time to achieve highest level of sensory block and maximum Bromage Score was achieved in significantly shorter time in LD group as compared LF and L groups. Segmental regression to S1 and complete motor regression to Bromage O was longer in group LD as compared to Group LF and L

Conclusion: We concluded that dexmedetomidine is a better adjuvant than fentanyl in epidural anesthesia as it produces early onset and more prolonged motor and sensory block, better sedation, prolonged analgesia and good patient satisfaction.

Keywords: Dexmedetomidine, Epidural Anaesthesia, Fentanyl, Levobupivacaine.

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INTRODUCTION

Epidural anaesthesia is a regional anaesthetic technique widely used in lower abdominal and lower limb surgeries.[1,2] Epidural block can be used as a single shot technique or with a catheter through which intermittent boluses or continuous infusion can be administered.[3,4] It offers superior pain relief and early mobilization especially when local anaesthetic is combined with an adjuvant. Levobupivacaine is the levostereoisomer of the racemic form of bupivacaine showing a profile close to bupivacaine in terms of onset, quality and duration of sensory block but with lesser cardiac and neurotoxic adverse effects. Greater intrinsic vasoconstrictor property of levobupivacaine may be responsible for longer sensory blockade as compared to racemic bupivacaine.[5,6]

A number of agents have been used as adjuvants to improve efficacy of epidural analgesia with local anaesthetics like opioids or alpha-2 agonists. They provide a dose sparing effect of local anaesthetics, accelerate the onset of sensory blockade of epidural anaesthesia and decrease the effective dose of local anaesthesic.[7] Local anaesthetics and opioid combination was shown to be more effective for postoperative pain relief as their effects started rapidly and lasted longer when compared with local anesthetic alone.[8]

Fentanyl, a short acting synthetic u receptor agonist has been shown to be an effective adjuvant in epidural anaesthesia with minimal risk of side effects at usual clinical doses of 25-100 ug.[9,10] Dexmedetomidine is the selective alpha 2 adrenoceptor agonist which acts on pre and post synaptic sympathetic nerve terminals and central nervous system to decrease the sympathetic outflow and nor epinephrine release. It has sympatholytic and

hemodynamic effects in addition to its sedative and analgesic properties. Motor blockade tends to be denser with dexmedetomidine. Dexmedetomidine is also devoid of respiratory depression, pruritis, nausea and vomiting.

This study was done to assess and compare the efficacy and safety of epidural fentanyl and dexmedetomidine as adjuvants to 0.5% Levobupivacaine in epidural anaesthesia in patients undergoing hip or lower limb surgeries.

MATERIALS AND METHODS

After obtaining approval from Hospital Ethical Committee, the present study was undertaken in the Department of Anaesthesiology and Intensive Care, Govt. Medical College Jammu. Informed written consent was obtained from the patients preoperatively. 90 patients of either sex ranging in the age group between 18 to 60 years belonging to ASA grade I & II, scheduled for hip and lower limb surgeries were selected. Pre anaesthetic check-up was done on a day before surgery.

Patients with raised intracranial pressure, hypovolemia, bleeding diathesis, hypersensitivity to study drug, local skin infection at spinal lumbar region, spinal deformity, patients on anticoagulants, morbidly obese patients (BMI > 35kg/m²), ASA grade III or more and patient's refusal to technique were excluded from the study.

Patients were randomly allocated to one of the three study groups, each group comprised of 30 patients.

- **Group L:** Patients in this group received Levobupivacaine (0.5%) 19ml with 1ml of normal saline (control).
- **Group LD:** Patients received Levobupivacaine (0.5%) 19ml with dexmedetomidine 50µg in 1ml.
- **Group LF:** Patients received Levobupivacaine (0.5%) 19ml with fentanyl 50µg in 1ml. The total volume of the drug was kept 20ml in all the groups.

All the patients were kept fasting for a period of 8 hours pre operatively and were given oral ranitidine 150 mg and alprazolam 0.25 mg night before surgery. A peripheral intravenous line was established with 18 G canula and preloading done with 10ml/kg infusion of Ringer Lactate solution in the preoperative room, 20 minutes before starting the procedure. After receiving the patient in the operation theatre, base line heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), ECG, oxygen saturation (SpO_2) & respiratory rate were recorded.

Epidural anaesthesia was administered in the sitting position at L4-L5 interspace with 18 G Tuohy needle by loss of resistance technique and with the bevel in the cephalic direction, an epidural catheter was inserted 5cm into the epidural space and was secured there.

After ensuring the correct placement of the catheter in the epidural space, the drug combination (depending upon the group and according to randomization schedule) was slowly injected at the rate of 3 ml/10 seconds through the epidural catheter.

The sensory blockade was assessed by bilateral pin prick method using a short bevelled 26 G hypodermic needle every 5 minutes for the first 30 minutes and every 15 min for the rest of the surgery. The time of onset of sensory block at T10 dermatome, peak level of sensory block and the time to reach the peak level was recorded. T10 level was accepted as sufficient to start the surgery. The duration of the sensory blockade was measured from the epidural injection till the regression of the sensory level to S1.

Degree of motor blockade according to Modified Bromage scale was assessed every 5 minutes for first 30 min after drug administration and then every 15 minutes for the rest of the surgery.

0 = No motor power impairment and able to raise straight leg;
1 = Unable to raise straight leg but able to flex knee;
2 = Unable to flex knee;
3 = Unable to flex ankle and foot. (No movement)

Grading of sedation was evaluated by using Ramsey sedation score.

1 = Awake, conscious, no sedation.
2 = Calm and composed.
3 = Awake on verbal command.
4 = Brisk response to gentle tactile stimulation.
5 = Unarousable.

Sedation score was recorded at the start of the procedure and at every 15 minutes during the surgery.

Post operatively sedation score, sensory level and Bromage score was recorded every 30 minutes in the recovery room. The sensory regression to S1 dermatome and motor regression to Modified Bromage 0 was recorded.

Pain intensity was assessed every 30 minutes with the help of Linear Visual Analogue Scale (VAS) using a 10 cm line, 0 denoting no pain while 10 denoting worst possible pain. Duration of analgesia was taken as time period till VAS score of 4 was recorded. Postoperative pain was managed with rescue injection of 3 ml of levobupivacaine (0.5%) and 1 ml of tramadol (50 mg) diluted to total of 10 ml with normal saline given through epidural catheter. The epidural catheter was kept for 24 hours in the postoperative period and postoperative analgesia was maintained with epidural top up depending upon the patient's need.

Cardio respiratory parameters of heart rate, blood pressure and SpO_2 were monitored continuously and recorded before (baseline) and every 5 minutes for first 30 minutes after the epidural injection, then every 10 minutes till the end of the surgery. For the present study, hypotension was defined as a fall in systolic B.P of more than 20% of baseline value or less than 100 mmHg and was treated with volume expansion and if required by incremental doses of mephenteramine 3-6mg. Bradycardia (heart rate <60/min) was treated with 0.3 mg of intravenous atropine. Incidence of other side effects seen with epidural drug administration like pruritis, nausea, vomiting, respiratory depression and post epidural shivering was carefully observed, recorded and managed symptomatically.

Plan of Analysis

The data was analysed with the help of computer software MS Excel and SPSS version 16.0 for windows. The quantitative variable was reported as mean and standard deviation. One way ANOVA was used to evaluate statistical significance among the groups. Intergroup comparisons were made using student's t-test and non parameteric variables were analysed by using Chi square test. All p values reported were two tailed and a p value of ≤ 0.05 was considered as statistically significant

RESULTS

90 patients were successfully operated under epidural levobupivacaine anaesthesia. The demographic profile, duration of surgery and haemodynamic parameters were comparable between the groups.

Table 1: Time of Onset at T_{10} (Sensory block)[In Mins]

Groups	Mean ± SD	F-value	P-value
Group LF	20.00 ± 3.94	17.35	0.0001
Group LD	15.17 ± 3.82		
Group L	21.67 ± 4.97		

Table 2: Highest level of Sensory block.

Highest level	No. of patients (%)		
	Group LF	Group LD	Group L
T5 – T6	8 (26.67)	25 (83.33)	1 (3.33)
T7 – T8	19 (63.33)	5 (16.67)	16 (53.33)
T9 – T10	3 (10.00)	0 (0.00)	13 (43.34)
P value		<0.0001	

Table 3: Time to reach highest level (Sensory block) [In Mins]

Groups	Mean ± SD	F-value	P-value
Group LF	27.33 ± 2.86	40.41	<0.0001
Group LD	22.33 ± 3.41		
Group L	28.67 ± 2.25		

Table 4: Time to attain maximum bromage score [In Mins]

Groups	Mean ± SD	F-value	P-value
Group LF	23.67 ± 3.70	26.84	<0.0001
Group LD	19.67 ± 4.90		
Group L	27.33 ± 3.41		

Table 5: Regression to S1 segment (min.)

Groups	Mean ± SD	F-value	P-value
Group LF	233.0 ± 30.19	109.66	<0.0001
Group LD	290.0 ± 34.64		
Group L	180.0 ± 19.30		

Table 6: Complete motor regression to bromage 0 (min)

Groups	Mean ± SD	F-value	P-value
Group LF	211.0 ± 28.93	56.82	<0.0001
Group LD	254.0 ± 35.00		
Group L	176.0 ± 18.86		

The three groups remained statistically comparable at all times as regards to the heart rate, blood pressure and SPO2. The difference was found to be statistically insignificant.

It was observed that in group LD there was a faster onset of sensory block as compared to group LF and group L. The highest level of sensory block obtained (T5-T6) was obtained in 83.33% of the patients in group LD, 26.6% of patients in group LF and 3.33% of the patients in group L. The difference was found to be statistically highly significant among the three groups. (p value<0.0001).The statistical analysis was done using Chi square test.(Table 1 & 2) The mean time to reach the highest level of sensory block was lesser in group LD as compared to group LF& group L. The above observations were found to be statistically highly significant by ANOVA test. (Table 3)

Maximum bromage score was attained earlier in group LD as compared to group LF or group L. The above observations were found to be statistically highly significant by ANOVA test. (Table 4)

The results of our study showed that the time taken to segmental regression to S1 dermatome was more in group LD as compared to group LF& group L. The above observations were found to be statistically highly significant by ANOVA test. (Table 5)

We observed that the time taken to complete motor regression to bromage 0 was more in group LD as compared to group LF& group L.The above observations were found to be statistically highly significant by ANOVA test.(p< 0.0001) (Table 6).

The mean duration of analgesia was more in group LD (292.0±29.41 minutes) when compared with group LF (225.0±33.19 minutes) & group L (178.0±19.19 minutes).The above observations were found to be statistically highly significant by ANOVA test. (p< 0.0001)

Sedation was assessed by using Ramsay Sedation score. The results of our study showed that sedation score of 3 was seen in 60% of the patients in group LD and 3.33% of the patients in group LF. Most of the patients in group L and LF had sedation score ≤ 2. All patients remained arousable to verbal commands and sedation score of more than 3 was not seen in any patient during this study. The difference was found to be statistically significant between the three groups. The statistical analysis was done using chi square test.

Hypotension was reported in 5 patients (16.67 %) in group LD and 2 patients (6.67%) in LF and 2 patients (6.67 %) in L group. Bradycardia was seen in 1 patient (3.33%) in group LF, 3 patients (16.67%) patients in group LD and 1 patient (3.33%) % in L group. The results were statistically insignificant among groups.

Nausea/vomiting was observed in 13% patients in group LF as compared to 3.33% in LD and L group. The result was found to be statistically significant with increased incidence of nausea/vomiting in LF as compared to LD and L group. 1 patient in LF group and none in LD and L group complained of pruritis in our study. The difference was found to be statistically significant.

Shivering was seen in 6.67% patients in LF, 3.33 % in L group and 0% in LD group. The results were statistically insignificant among three groups. None of the patients in our study developed any complaints in the form of respiratory depression, headache, dry mouth, urinary retention throughout the observation period of the study.

DISCUSSION

Epidural anaesthesia is the most commonly used technique for providing not only perioperative surgical anaesthesia but also postoperative analgesia in lower abdominal and limb surgeries.

This study has compared fentanyl and dexmedetomidine as adjuvants to levobupivacaine in epidural anaesthesia. Although Fentanyl has largely replaced morphine as an adjuvant, however the incidence of vomiting in patients receiving epidural with fentanyl still ranges between 28% and 52% depending on the study population and concentration used.[11] Dexmedetomidine is a new addition to the class of alpha 2 agonists which has got numerous beneficial effects. Although it causes hypotension and bradycardia but there is lack of opioid related side effects like respiratory depression, pruritis, nausea and vomiting.[12]

The three groups were found to be statistically comparable as regards to the distribution of baseline haemodynamic characteristics and these groups remained haemodynamically stable throughout the study period.

The time taken in minutes for onset of sensory block at T10 level was found to be 21.67 ± 4.97 minutes in group L, 15.17 ±3.82 minutes in group LD, 20 ±3.94 minutes in group LF. This difference was found to be statistically significant between group LD and LF. This was in accordance with Gupta K et al who found that the onset of sensory analgesia and establishment of complete motor blockade was significantly earlier with dexmedetomidine versus fentanyl when combined with ropivacaine in epidural anaesthesia in TURP in elderly patients.[13]

The addition of fentanyl also hastened the onset of sensory block. These findings are in accordance with Cherng H et al who concluded that the addition of 100 µg fentanyl to 1% ropivacaine solution accelerated the onset of sensory block during epidural anaesthesia.[14]

Peak level of sensory block (T5-T6) was obtained in 83.33% of the patients in group LD, 26.6 % of patients in group LF and 3.33 % of the patients in group L. The difference was found to be statistically significant among the three groups. Our results were in accordance with Attri JP et al who showed onset of sensory block and time to reach maximum sensory block was rapid in group LF as compared to group L.[15]

The mean time to reach the highest level of sensory block was found to be 28.67 ± 2.25 minutes in group L, 27.33 ± 2.86 minutes in group LF and 22.33 ± 3.41 minutes in group LD. The difference was found to be statistically significant. On intergroup comparison the time taken in establishment of highest level of sensory block was found to be significantly decreased in group LD as compared to group LF and L. The total duration of sensory block was also found to be significantly increased in group LD as compared to group LF and group L.

The time to attain maximum bromage score was 19.67 ±4.90 minutes in group LD, 23.67± 3.70 minutes in group LF, and 27.33 ± 3.41 minutes in group L. The difference was found to be statistically significant. Our results are in accordance with Paula F Salgado et al concluded in their study that adding dexmedetomidine 1µg/kg to epidural ropivacaine increases sensory and motor block duration and prolongs postoperative analgesia without causing haemodynamic instability.[16]

The total duration of motor block was also found to be significantly prolonged in group LD and group LF as compared to group L.

The duration of analgesia as defined by the time to reach a VAS of 4 and provision of first rescue analgesia in form of epidural top up was found out to be significantly different between the three groups. The mean duration of analgesia in was found to be 292.0±29.41 minutes in group LD 225.0 ±33.19 minutes in group LF and 178.0 ±19.19 minutes in group L. The difference was found to be statistically significant. Our results are in accordance with Gupta R et al who showed that the time to rescue analgesia was significantly longer in dexmedetomidine group as compared to fentanyl group with bupivacaine.[17]

Arun Pothan and Vijay Narayan concluded that dexmedetomidine fastens the onset of analgesia and prolongs the duration of analgesia without any disturbance in haemodynamic parameters.[18] Selim MF et al compared bupivacaine-dexmedetomidine and bupivacaine-fentanyl in epidural analgesia for patients in labour and showed that dexmedetomidine gave better maternal satisfaction for labour pains than fentanyl when used as an adjuvant drug to local anaesthetics because of its earlier onset, longer duration of analgesia and fewer side effects.[19]

Our results suggest that epidural usage of dexmedetomidine as an adjuvant to levobupivacaine is associated with a higher incidence of sedation. Oriol Lopez SA et al stated that the use of dexmedetomidine by epidural route at 1µg/kg dose with local anaesthetics is an alternative to achieve an anaesthetic quality that enables us to keep the patient in a state of active sedation which reduces the likelihood of respiratory depression which can arise when adjuvant drugs are administered intravenously.[20]

CONCLUSION

In our study we conclude that dexmedetomidine is a better adjuvant than fentanyl in epidural anaesthesia as it produces earlier onset as well as more prolonged motor and sensory block, better sedation, prolonged analgesia, stable cardio respiratory parameters and better patient satisfaction.

REFERENCES

1. Longo S. Postdural puncture: implications and complications. Curr opin Anaesth 1999; 12: 271-5.
2. Kleinman W. Regional anaesthesia and pain management: spinal, epidural and caudal blocks. Clinical anaesthesiology. 2002: 253-82.
3. Visser L. Epidural anaesthesia. Anaesth (update) 2001; 13:1-4.
4. Ben David B, Swanson J, Nelson JB, Chelly JE. Multimodal analgesia for radical prostectomy provides better analgesia and shortens hospital stay. Journal of clinical anaesthesiology 2007; 19: 264-8.
5. Kopacz DJ, Allens HW, Thompson GE. A comparative of epidural levobupivacaine 0.75% with racemic bupivacaine for lower abdominal surgery. Anaesth Analogue 2000; 90: 642-8.
6. Foster RH, Markham A. Levobupivacaine, a review of its pharmacology and use as a local anaesthetic. Drugs 2000; 59: 551-79.
7. Gabriel JS, Cordin V. Alpha 2 agonists in regional anaesthesia and analgesia. Curr Opin Anaesthesiol 2001;14:751-3
8. Ozalp G, Guner F, Kuru N et al. Postoperative epidural analgesia with opoid bupivacaine mixtures. Can J Anaesth 1998; 45: 938-42.
9. Paech MJ, Westmore MD, Speirs HM. A double blind comparison of epidural bupivacaine and bupivacaine fentanyl for caesarean section. Anaesth Intens Care 1990; 18: 22-30.
10. Halonen PM , Paatero H, Hovorka J, Haasio J, Korttila K. Comparison of two fentanyl doses to improve epidural anaesthesia with 0.5% bupivacaine for caesarean section. Acta Anaesthesiol Scand 1993; 37: 774-9.
11. Gedney JA, Liu EH. Side effects of epidural infusions of opioid bupivacaine mixtures. Anesthesia 1998; 53:1148-55
12. Venn RM, Hell J, Grounds RM. Respiratory effects of dexmedetomidine in surgical patient requiring intensive care. Crit Care 2000; 4: 302-8.
13. Gupta K, Gupta PK, Rastogi B, Jain M. Dexmedetomidine versus fentanyl as adjuvant to epidural 0.5% levobupivacaine for transurethral prostate resection in elderly patients : a comparative evaluation.AinsShamsJournal of Anaesthesiology2016;3:398-402.
14. Cherng CH, Yang CP, Wong CS. Epidural fentanyl speeds the onset of sensory and motor blocks during epidural ropivacaine anaesthesia. Anaesthesia & Analgesia 2005; 101: 1834-37.
15. Attri JP, Kaur G, Kaur S, Kaur R, Mohan B, Kashyap K. Comparison of levobupivacaine and levobupivacaine with fentanyl

in infra umbilical surgeries under spinal anaesthesia. Anaesth Essays Res 2015; 9: 178-84.
16. Paula F Salgada, Paulo Nascimento, Norma Sueli P et al. Adding Dexmedetomidine to Ropivacaine 0.75 % for epidural anaesthesia. Does it improve the quality of Anaesthesia. Anaesthesiology 2005, 103; A 974.
17. Gupta R, Verma R et al. A comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to bupivacaine. Journal of Anaesthesiology Clinical pharmacology2011;27:339-43.
18. Pothan Arun, Narayan Vijay. A comparative study of epidural levobupivacaine versus epidural 0.5% levobupivacaine with dexmedetomidine, analgesia and haemodynamics. Journal of Evolution of Medical and Dental Sciences 2015; 4: 9978-89.
19. Selim MF, E Ali AM, Ali Hasan AM. Comparative evaluation of epidural bupivacaine-dexmedetomidine and bupivacaine-fentanyl on Doppler velocimetry of uterine and umbilical arteries during labour. Journal of prenatal medicine. 2012 ; 6: 47-54.
20. Oriol-Lopez SA, Maldonado-Sanchez KA et al. Epidural dexmedetomidine in regional anaesthesia to reduce the anxiety. Anesthesiologia 2008; 31: 271-7.

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