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THE STUDY OF DEXMEDETOMIDINE AND FENTANYL FOR EPIDURAL ANALGESIA FOR LOWER LIMB ORTHOPEDIC SURGERY.

Anesthesiology

Dr. Satyendra Kumar Senior Resident, Department of Anesthesiology, Vardhman Institute Of Medical Sciences, Pawapuri, Nalanda, Bihar-803115.

Dr. Rajendra Prasad* Associate Professor, Deptt of Anesthesiology, Vardhman Institute Of Medical Sciences, pawapuri, Nalanda, Bihar-803115. *Corresponding Author

Dr. Nirmal Kumar Assistant professor, Deptt Of Anesthesiology, Vardhman Institute Of Medical Sciences, Pawapuri, Nalanda, Bihar-803115.

Dr. Debarshi Jana IPGMER and SSKM Hospital, Kolkata.

ABSTRACT

Aim: Comparative evaluation of dexmedetomidine and fentanyl for epidural anaesthesia in lower limb orthopedic surgery.
Methods: Patients undergoing lower limb orthopaedic surgery aged between 21 to 50 years. For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5.
Result: Difference of mean age with both groups was not statistically significant (p=0.217). Difference of mean duration of surgery with both groups was not statistically significant (p<0.001).Difference of mean onset time of sensory block (at T10) with both groups was statistically significant (p<0.001). Difference of mean time of onset of moter block with both groups was statistically significant (p<0.001).
Conclusion: Dexmedetomidine seems to be a better alternative to fentanyl for epidural anaesthesia because of intense analgesia, better quality of motor block and prolong post op analgesia, along with higher sedation scores.

KEYWORDS

Dexmedetomidine, Fentanyl, Lower limb.

INTRODUCTION

Epidural anesthesia is the most commonly used technique for providing not only peri-operative surgical anesthesia but post-op analgesia in lower abdominal and limb surgeries.[1] Early postoperative mobilization and rehabilitation with minimally associated pain and discomfort is the most desirable feature in modern orthopaedic surgery.[2] For achieving this effect, large volumes of local anesthetics were used which also increase the possibilities of local anesthetic toxicity and hemodynamic instability.[3]The new amide local anaesthetic Ropivacaine has minimal cardio-vascular and central nervous system toxicity as well as a lesser propensity of motor block during post-operative epidural analgesia.[4]Opioids like fentanyl have been used traditionally as an adjunct for epidural administration in combination with a lower dose of local anaesthetic to achieve the desired anaesthetic effect.[5]The addition of opioid does provide a dose sparing effect of local anaesthetic and superior analgesia but there is always a possibility of an increased incidence of pruritis, urinary retention, nausea, vomiting and respiratory depression.[6] Also the incidence of motor block after epidural analgesia with amide local anesthetics (LA) and opioids is approximately 4-12% which itself defeats the novel purpose of early rehabilitation.[7]

Dexmedetomidine is a new addition to the class of alpha-2 agonist which has got numerous beneficial effects when used through epidural route.[8] It acts on both pre and post synaptic sympathetic nerve terminal and central nervous system thereby decreasing the sympathetic outflow and nor-epinephrine release causing sedative, anti-anxiety, analgesic, sympatholytic and haemodynamic effects.[9] Dexmedetomidine does cause a manageable hypotension and bradycardia but the striking feature of this drug is the lack of opioid-related side effects like respiratory depression, pruritis, nausea, and vomiting.[10,11]

The present study aims at comparative evaluation of dexmedetomidine and fentanyl for epidural anaesthesia in lower limb orthopedic surgeries in terms of evaluation of sensory and motor blocks in regards to onset, duration and quality of epidural anaesthesia and duration of analgesia and rescue analgesic requirement.

MATERIALS AND METHODS

100 Patients undergoing lower limb orthopaedic surgery of both genders, age ranging from 21 to 50 years in Department of Anesthesiology, Vardhman Institute Of Medical Sciences, Pawapuri, Nalanda, Bihar, 803115. The study group was divided into two groups of equal size.

Group RD (15ml ropivacaine +1µg/kg dexmedetomidine) and Group RF (15ml ropivacaine + 1µg/kg fentanyl).

Statistical Analysis:

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as meanand standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. One-way analysis of variance (one-way ANOVA) was a technique used to compare means of three or more samples for numerical data (using the F distribution). A chi-squared test ($\chi 2$ test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

The Mann–Whitney U test is a nonparametric test of the null hypothesis that it is equally likely that a randomly selected value from one sample is less than or greater than a randomly selected value from a second sample. This test can be used to determine whether two independent samples were selected from populations having the same distribution; a similar nonparametric test used on dependent samples is the Wilcoxon signed-rank test.

Z-test (Standard Normal Deviate) was used to test the significant difference of proportions. Correlation was calculated by Pearson correlation analysis. The Pearson product-moment correlation coefficient was a measure of the linear dependence between two variables X and Y. Multivariate analysis was performed by logistic regression method for calculation of risk factors. The Kaplan–Meier estimator (Kaplan-Meier survival analysis) was a non-parametricstatistic used to estimate the survival function from time data.

Explicit expressions that can be used to carry out various *t*-tests are given below. In each case, the formula for a test statistic that either exactly follows or closely approximates a *t*-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test.

Once a *t* value is determined, a *p*-value can be found using a table of values from Student's t-distribution. If the calculated *p*-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis.

p-value ≤ 0.05 was considered for statistically significant.

RESULT AND ANALYSIS

Our study showed that in Group RD, 14(28%) male patients and 36(72%) female patients were present.In Group RF, 21(42%) male patients and 29(58%) female patients were present which was not statistically significant (p=0.175).

We found that in Group RD, the mean age (mean±s.d.) of patients was 38.18±10.20 years. In Group RF, the mean age (mean±s.d.) of patients was 37.25±10.08 years. Difference of mean age with both groups was not statistically significant (p=0.217).

In Group RD, the mean body weight (mean±s.d.) of patients was 59.02±8.42kg. and in Group RF, the mean body weight (mean±s.d.) of patients was 58.36±5.54kg. Difference of mean body weight with both groups was not statistically significant (p=0.963). In Group RD, the mean duration of surgery (mean±s.d.) of patients was 102.4±30.36 and in Group RF, the mean duration of surgery (mean±s.d.) of patients was 107.72±33.28. Difference of mean duration of surgery with both groups was not statistically significant (p<0.001).

It was found that in Group RD, the mean onset time of sensory block (at T10) (mean±s.d.) of patients was 9.12±0.89 mins and in Group RF, the mean onset time of sensory block (at T10) (mean±s.d.) of patients was 11.25±0.94 mins. Difference of mean onset time of sensory block (at T10) with both groups was statistically significant (p<0.001).

In Group RD, the mean time of onset of moter block (mean±s.d.) of patients was 10.11±1.05 minsand in Group RF, the mean time of onset of moter block (mean±s.d.) of patients was 13.32±1.14 mins. Difference of mean time of onset of moter block with both groups was statistically significant (p<0.001).

We found that in Group RD, the mean time to Achieve the Complete Motor Block (mean±s.d.) of patients was 17.9±1.86 mins and in Group RF, the mean time to Achieve the Complete Motor Block (mean±s.d.) of patients was 22.89±1.25 mins. Difference of mean Time to Achieve the Complete Motor Block with both groups was statistically significant (p<0.001).

In Group RD, the mean duration of moter block (mean±s.d.) of patients was 232.85±10.34 mins and in Group RF, the mean Duration of moter block (mean±s.d.) of patients was 178.7±9.14 mins. Difference of mean Duration of moter block with both groups was statistically significant (p<0.001).

We also found that in Group RD, 8(16.00%) patients had a Sedation Point 2, 18(36.00%) patients had a Sedation Point 3, 21(42.00%) patients had a Sedation Point 4 and 3(6.00%) patients had a Sedation Point 5.In Group RF, 42(84.00%) patients had a Sedation Point 2 and 8(16.00%) patients had Sedation Point 3. Association of Sedation Point vs. two groups was statistically significant (p<0.0001).

Table 1: Distribution Of Gender

Gender	Group RD		Group RF		
	Number	Percent	Number	Percent	P value
Male	14	28	21	42	p=0.175
Female	36	72	29	58	

Table 2: Distribution Of Mean Age, Body Weight And Duration Of Surgery: Both Groups

Variables	Group RD	Group RF	P value
Age group	38.18±10.20	37.25±10.08	p=0.217
Body weight	59.02±8.42	58.36±5.54	p=0.963
Duration of surgery	102.4±30.36	107.72±33.28	p<0.001

Table 3: Difference Of Initial Block Characteristics In Both The Groups

Variables	Group RD	Group RF	P value
Onset time of sensory block in min (at T10)	9.12±0.89	11.25±0.94	p<0.001
Time of Onset of moter block	10.11±1.05	13.32±1.14	p<0.001
Median level of block	T5	T6	-
Time to Achieve the Complete Motor Block (min)	17.9±1.86	22.89±1.25	p<0.001
Duration of moter block (min)	232.85±10.34	178.7±9.14	p<0.001

Table 4: Comparison Of Sedation Point In Study Population.

Sedation Point	Group RD		Group RF		
	Number	Percent	Number	Percent	P value
2	8	16.00	42	84.00	<0.0001
3	18	36.00	8	16.00	
4	21	42.00	0	0.00	
5	3	6.00	0	0.00	

DISCUSSION

Maroof et al, were found that Dexmedetomidine has the physiological properties sedation such as, analgesia, it reduces the stress response to the surgery by reducing plasma catecholamine concentration and prevents shivering via α2 adrenoceptors in the central nervous system.[12] Dexmedetomidine has unique sedative properties caused by hyperpolarization of excitable cells in the locus coeruleus by Berridge et al.[13]

In our study, we found that age wise distribution of patients in both the groups did not show any statistically significant difference (p=0.217). Weight of patients in both the groups did not show any statistically significant difference (p=0.963).

It was found that time to achieve sensory level at T10 was significantly lower in Group RD (9.12±0.89 mins) as compared to Group RF (11.25±0.94 mins) and onset of motor block with Group RD was (10.11±1.05mins) compared to Group RF (13.32±1.14 min).

Moreover, Bajwa et al. additions of dexmedetomidine to ropivacaine as an adjuvant resulted in an earlier onset (8.52 ± 2.36 min) of sensory analgesia at T10 as compared to the addition of clonidine (9.72±3.44 min) comparison.[14] Rastogi et al, found that epidural administration of 15mL of 1% ropivacaine plus 100µg fentanyl has onset times of motor block up to Bromage scale 1 and 2 were significantly more rapid in the fentanyl group (11.9 +/- 4.6 and 24.4+/- 5.9 min).[15]

In addition, Kaur et al found that Epidural dexmedetomidine (1µg/kg) as an adjuvant to ropivacaine 0.75% 15ml is associated with T5 level of block.[16]

In present study, the mean of Complete Motor Block (mean±s.d.) of patients was higher (22.89±1.25 mins) in Group RF as compared to the mean of Complete Motor Block (17.9±1.86 mins) which was statistically significant (p<0.001). In Group RD, the mean duration of moter block (mean±s.d.) of patients was 232.85±10.34 mins and in Group RF, the mean Duration of moter block (mean±s.d.) of patients was 178.7±9.14 mins. Difference of mean Duration of moter block with both groups was statistically significant (p<0.001).

Dexmedetomidine produced profound sedation (sedation score 4), 42% patients, in Group RD, as compared to no sedation (sedation score 4) in fentanyl Group. In Group RD 36% of patients and 16% of patients in Group RF were responsive to commands only.

CONCLUSION

Dexmedetomidine seems to be a better alternative to fentanyl for epidural anaesthesia because of intense analgesia, better quality of motor block and prolong post op analgesia, along with higher sedation scores.

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