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Original Research Article

Dexmedetomidine and fentanyl for epidural analgesia in lower limb orthopedic surgeries: a comparative evaluation

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ABSTRACT

Background: Epidural anesthesia is the most frequently used technique for providing operative analgesia in lower abdominal and limb surgeries. This study aimed at comparative evaluation of dexmedetomidine and fentanyl for epidural anaesthesia in lower limb orthopedic surgeries.
Methods: This study was conducted in the department of Anesthesiology and critical care Medicine, MLB Medical College Jhansi. Patients undergoing lower limb orthopaedic surgery aged between 21 to 50 years and belonging to American Society of Anaesthesiologist (ASA) grade 1or 2 were included. Informed and written consent was obtained. Subjects were divided into two groups. Statistical analysis was done using SPSS version 16.0 software. t-test, Chi-square test, and Mann-Whitney tests were applied.
Results: Age wise distribution, body weight and mean duration of surgical time was comparable in both groups and found statistically insignificant. Time to achieve sensory level at T10 was found to be significantly less in Group RD as compared to Group RF. Early onset of motor block in Group RD was seen (10.12min) as compared to fentanyl (13.36min). Complete motor block was achieved in significantly lower time by Group RD as compared to Group RF. Duration of motor block was significantly higher in Group RD as compared to Group RF subjects. Better sedation score was found in Group RD.
Conclusions: Dexmedetomidine is better as an adjuvant to ropivacaine than fentanyl for epidural anaesthesia because of intense analgesia, better quality of motor block and prolong post-operative analgesia, along with higher sedation scores.

Keywords: Dexmedetomidine, Epidural anesthesia, Fentanyl, Lower limb

INTRODUCTION

Epidural anesthesia is the most frequently 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 simply connected pain and discomfort is the most desirable feature in modern orthopaedic surgery.[2-4] Many a time for achieving desired peri-operative anaesthetic effect, invariably large volumes of local anaesthetics are used, thus increasing the possibilities of local anaesthetic toxicity and deleterious haemodynamic consequences. 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.[5,6] Opioids like fentanyl have been used customarily as an adjunct for epidural administration in combination with a lower dose of local anaesthetic to achieve the desired anaesthetic effect.[7] 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.[8,9] 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.[10-12]

Dexmedetomidine is a new addition to the class of alpha-2 agonist which has got numerous valuable effects when used through epidural route.[13] 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.[14-16] 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.[17,18] 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.

METHODS

This one-year study was conducted in the department of Anesthesiology and critical care Medicine, MLB Medical College Jhansi on patients admitted for lower limb orthopaedic surgery. Institutional Ethical clearance was taken. 100 Patients undergoing lower limb orthopaedic surgery of both genders, age ranging from 21 to 50 years and belonging to American Society of Anaesthesiologist (ASA) grade 1or 2 were screened and included in the study. After taking informed and written consent was obtained from all patients, detailed history and physical examination. Airway examination was done. 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). Each patient was observed for

- Time of onset of sensory block.: It is defined as the time interval between administrations of local anesthetic epidurally to the loss of pinprick sensation at the site of surgical incision.
- Time of onset of Motor block: (time taken to achieved Modified Bromage motor scale 1)
- Height of block. (by pin prick)
- Intensity of Motor Block-(time taken to achieve Modified Bromage motor scale 3)
- Duration of block.
- Duration of analgesia (onset of sensory block to first demand of rescue analgesic)
- Level of sedation: It was evaluated using Ramsey sedation scale. Sedation scores were recorded just before the initiation and at every 20min during surgery. Maximum sedation score was noted.

Statistical analysis

Statistical analysis was done using SPSS version 16.0 software. t-test, Chi-square test, and Mann-Whitney test were applied according to the requirement. The level of significance was fixed at 95%. P<0.05 was considered statistically significant.

RESULTS

A total 100 patients undergoing lower limb orthopaedic surgeries of both genders age ranging from 21 to 50 years belonging to American Society of Anaesthesiologist (ASA) grade 1or 2 where be screened out for the purpose of study.

Table 1: Gender wise distribution of study population.

Gender	Group RD		Group RF	
	Number	Percent	Number	Percent
Male	11	22	17	34
Female	39	78	33	66

Table 1 shows higher proportion of females were found in Group RD (78.0%) as compared to Group RF (66.0%) but this difference was statistically non- significant (p=0.181). This indicates that subjects included in the study were matched on the basis of gender.

Table 2: Demographic anthropometric profile and mean duration of surgical time of subjects.

Variables	Group RD	Group RF	P value
Age group	38.22±10.23	37.28±10.06	P >0.05
Body weight	59.00±3.62	58.98±3.99	P >0.05
Duration of surgery	107.4±31.99	110.82±36.18	P >0.05

Table 2 show age wise distribution of patients in both the groups did not show any statistically significant difference (p=0.216), which indicate that there was no bias of age in the two groups subjects according to their body weight not show any statistically significant difference (p=0.979). Mean duration of surgical time was comparable in both group and statistically insignificant (P>0.05).

Table 3 shows that time to achieve sensory level at T10 was found to be significantly less (p<0.001) in Group RD (9.22+0.86 min) as compared to Group RF (11.30+0.99 min). Early onset of motor block shows that significantly (p<0.001) with Group RD was (10.12 min) as compared to fentanyl (13.36 min). Maximum sensory level of T6 or above was achieved by significantly higher proportion (p<0.001) of subjects of Group RF (60%) as compared to Group RD (48%). In Group RD median level of block was T5 as compared to T6 in Group RF. Time to achieve complete motor block in Group RD was 17.0+1.53 minutes and in Group RF it was found to be 24.02+1.17

minutes. Complete motor block was achieved in significantly lower (p<0.001) time by Group RD subjects as compared to Group RF subjects. Duration of motor block in Group RD was 231.88+10.46 minutes and in Group RF it was found to be 209+9.24 minutes. Duration of motor block was significantly higher (p<0.001) in Group RD subjects as compared to Group RF subjects.

Table 3: Comparison of initial block characteristics in both the groups.

Variables	Group RD	Group RF	P value
Onset time of sensory block in min (at T10)	9.22±0.86	11.30±0.99	p<0.001
Time of Onset of moter block	10.12±1.01	13.36±1.11	p<0.001
Median level of block	T5	T6	p<0.001
Time to Achieve the Complete Motor Block (min)	17.7±1.82	24.02±1.17	p<0.001
Duration of moter block (min)	231.88±10.46	189.7±9.24	p<0.001

Table 4: Comparison of sedation Point in Study Population.

Sedation Point	Group RD		Group RF	
	Number	Percent	Number	Percent
2	6	12.00	44	88.00
3	20	40.00	6	12.00
4	23	46.00	0	0.00
5	1	2.00	0	0.00

p value <0.01

Table 4 shows that sedation point 2 was found in significantly higher proportion of subjects from Group RF (88%) as compared to Group RD (6%). None of the subjects from Group RF reported Sedation point 4, 5. In Group RD sedation score was 4and5 in most of case i.e. better sedation score was found in Group RD.

DISCUSSION

Epidural analgesia offers superior pain relief and early mobilization especially when local anesthetic dose is combined with an adjuvant as compared to LA used alone.[2] Study which has compared the effects of epidurally administered dexmedetomidine and fentanyl. The demographic profile in the present study was comparable to similar other studies and did not show any significant difference on statistical comparison. Compare the effect of dexmedetomidine (α-2 adrenoreceptor agonist) with fentanyl (a synthetic opioid) as adjuvant to ropivacaine in study. Dexmedetomidine which has been used in spinal, epidural, caudal, oral and intraarticular routes to provide analgesia was used in the current study. 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.[19] Dexmedetomidine has unique sedative properties caused by hyperpolarization of excitable cells in the locus coeruleus by Berridge et al.[20] In the present study analysis of the demographic profile the age and weight were comparable in both the groups. Age wise distribution of subjects in both the groups did not show any statistically significant difference (p=0.216). Weight of study subject in both the groups did not show any statistically significant difference (p=0.979). In present study, time to achieve sensory level at T10 was found to be significantly lower in Group RD (9.22+0.86 min) as compared to Group RF (11.30+0.99 min) and onset of motor block with Group RD was (10.12 min) as compared to fentanyl (13.36 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.[21] 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).[22]

Maximum sensory level of T6 or above was achieved by significantly higher proportion of subjects of Group RF (52%) as compared to Group RD (44%). In Group RF median level of block was T6 as compared to T5 in Group RD. 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.[23] In present study, complete motor block was achieved in significantly lower (p<0.001) time by Group RD subjects as compared to Group RF subjects. Dexmedetomidine produced profound sedation (sedation score 4), 46% patients, exhibited brisk response to light glabellas tap or loud auditory stimulus in Group RD, as compared to no

sedation (sedation score 4) in fentanyl Group. In Group RD 40% of patients and 12% of patients in Group RF were responsive to commands only. In Group RF 88% of patients were found to be co-operative, oriented, and calm as compared to12% of patients in Group RD. Sedation point was highly significant with administration of dexmedetomidine.

CONCLUSION

Concluded that dexmedetomidine is better as an adjuvant to ropivacaine than 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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