DEXMEDETOMIDINE VERSUS FENTANYL IN LOWER LIMB ORTHOPEDIC SURGERIES: A COMPARATIVE EVALUATION

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Abstract

Abstract: opioids and local anesthetics have been the traditional choice in epidural analgesia. However opioids suffer from the issue of side effects and respiratory depression. The use of newer agent like dexmedetomidine is a viable option. The present study was formulated to provide a comparative assessment of whether fentanyl or dexmedetomidine is a better adjuvant for lower limb surgeries in which epidural route is used. The study included a pool of 30 subjects who were divided in two equal groups and administered fentanyl or dexmedetomidine. The results displayed a shorter duration of sensory block and motor block in dexmedetomidine group as compared to fentanyl. The overall efficacy of dexmedetomidine was better in the present study.

Keywords: analgesia, dexmedetomidine, epidural, fentanyl

Introduction

In lower limb surgeries in orthopedics, a routinely used procedure is epidural anesthesia. The process provides an additional advantage of post-operative analgesic administration in addition to its obvious operative use. (1) However in certain instances, the use of local anesthesia is more than needed so as to provide a reduction in time required for mobilization and subsequent rehabilitation. The reduction is consequential to use of larger than needed volumes of anesthetics that can be causing toxicity and possible adverse effects. The use of opioid analgesics like fentanyl has been commonplace in epidural anesthesia due to its effective pain control mechanism. An addition of a local anesthetic agent with fentanyl has been optimal in providing desired outcomes in lower limb orthopedic cases. (2,3) The major issue in using a opioid analgesic has been the incidence of side effects such as nausea, vomiting, respiratory depression and urinary retention. (4)

This was found to reduce when a newer drug-dexmedetomidine was used. An alpha 2 agonist, dexmedetomidine has proven to have multiple benefits over older established agents especially when used through the epidural route. (5) The action of dexmedetomidine is over the pre and post synaptic sympathetic nerve terminals as well as along the entire central nervous system. This leads to a reduction of sympathetic activity in the body providing a state of lowered anxiety as well as effective sedation. (6) The drawback with dexmedetomidine is some hemodynamic issues such as fall in blood pressure and mild bradycardia. However the other adversities such as respiratory depression etc are absent. (7-8)

The present study was conducted with an aim to assess the comparative efficacy of dexmedetomidine and fentanyl on anesthetic effects and post-operative pain relief in lower limb orthopedic surgery cases.

Methodology

The present study was a prospective, randomized study conducted over a period of 6 months in Pacific Institute of Medical Sciences, Udaipur. The study proposal was presented to institutional ethical board and clearance was obtained prior to starting the study. The study sample comprised of 30 subjects in the age range of 21-57 years. The subjects were randomly divided in two groups D and F. Group D received dexmedetomidine as an adjuvant with Ropivacaine, while group F received fentanyl with ropivacaine. All subjects were informed of the study parameters and written informed consent was obtained prior to their inclusion. The subjects included were in ASA grade I or II, with no preexisting chronic illnesses or allergies to agents being used. Pre-operative medications and procedures were done as per institutional protocols. Vital parameters were noted in the pre, peri- and post-operative period. Lumbar epidural anaesthesia was induced using 18G Touhy needle with patients in the sitting position in L3-L4 interspace and location of epidural space was confirmed by loss of resistance technique. A test dose of 3 ml of 2% lignocaine with adrenaline was administered into epidural space and thereafter epidural catheter was secured 3-5 cm into the epidural space and patients were placed supine. 15 ml ropivacaine (0.75 %) with 1 µg/kg of dexmedetomidine

was administered for Group D, while group F was given 1 µg/kg of fentanyl. Parameters of anaesthetic action, sedation, analgesia and vital parameters were recorded at pre-determined times. All the data was compiled in an MS Excel worksheet and statistical analysis was done using SPSS ver 21 software.

Observations

The study sample comprised of 30 subjects divided in two groups of 15 subjects each. The mean age of the subjects was 38.66 ± 13.22 years. There were no statistically significant differences in the demographic parameters in the subjects of the study.

Table 1: Anesthetic Block Parameters

Feature	Group D	Group F	p-Value
Time for Block onset (mins)	7.11 ± 2.34	9.09 ± 1.95	0.011
Time for Maximum Block (mins)	14.44 ± 5.12	17.06 ± 5.34	0.024
Time for motor Block (mins)	19.78 ± 4.77	23.55 ± 3.98	0.027

In the selected study sample, it was observed that the onset of analgesic effect was significantly earlier in Group D as compared to group F. The other early block characteristics also exhibited similar results as dexmedetomidine not only provided a higher dermatomal spread but also helped in achieving the maximum sensory anaesthetic level in a shorter period. Motor block was assessed using modified Bromage scale and complete motor block was achieved significantly

earlier in the patients who were administered dexmedetomidine as compared to fentanyl group (Table 01) Dexmedetomidine has been reported to have good efficacy as a sedative agent and similar findings were observed in our study as 38% and 42% of patients exhibited grade II and grade III sedation as compared to 16% and 2% of patients in the RF group, respectively. These sedation scores were highly significant on statistical comparison

Table 2: Post-operative block features

Feature	Group D	Group F	p-Value
Time for motor Block regression (mins)	271.6 ± 21.44	188.8 ± 19.95	0.006
Time for Sensory Block regression (mins)	332.8 ± 25.32	212.6 ± 26.34	0.009
Time for first top up (mins)	377.0 ± 24.77	239.7 ± 23.98	0.012
Total Ropivacaine use (mg)	87.0 ± 11.67	107 ± 21.34	0.029

The result analysis revealed statistically significant values on post-operative block characteristics among the study groups. Though both the drugs provided a stable and prolonged post-operative analgesia but the effects of dexmedetomidine were significant on statistical analysis as compared to fentanyl. (Table 2)

In terms of adverse effects, Nausea (26%) and vomiting (12%) were observed to a significant extent in the group F with a comparative population of just 14 and 4%, respectively, in the group D. The incidence of other side effects like headache, shivering, dizziness, and urinary retention were comparable in both the groups and statistically non-significant

Discussion

Studies have reported that best effects of epidural anesthesia are achieved when the local anesthetic agent is added on as compared to singular local anesthetic. There were established evidence based studies that support the use of opioid analgesics with epidural local anesthetics, however newer agents such as dexmedetomidine still need further research on smaller and larger samples to assess any shortcomings. (9,10) To fill this lacuna this particular study was undertaken.

The study revealed that the demographic profile was uniform in both the groups and is comparable with other studies on

similar topics. It was seen that dexmedetomidine took a statistically significant shorter time to reach the peak sensory block level as compared to fentanyl. Throughout the surgery, patients were stable in both the groups but sedation scores were better in a significant manner in the dexmedetomidine group as 38% and 42% of patients had grade II and III sedation scores during the peri-operative period as compared to 16% and 2% of patients in the fentanyl group. The sedative properties of dexmedetomidine are far superior to fentanyl as per the study.

The analgesia effects were assessed using visual analogue scale (VAS) and subjects in both the groups showed 0 scores during the entire peri-operative period. In the present study, highly effective analgesic properties of LA and dexmedetomidine have been noted. Not only was the decrease in the dose of local anaesthetic in both the groups present but also the duration of post-operative analgesia was significantly elevated in patients in whom dexmedetomidine was administered as adjuvant with ropivacaine.

Bromage scale value 3 was achieved in all the subjects before the initiation of surgical procedure. The return of complete motor recovery was significantly earlier in the dexmedetomidine group as compared to fentanyl group. Post-operatively, the number of analgesic top-up doses of ropivacaine in group dexmedetomidine was significantly

lower than the requirement for ropivacaine in group administered fentanyl.

Hemodynamic stability was one of the most remarkable features observed with addition of dexmedetomidine and fentanyl to epidural ropivacaine. Decrease in heart rate is a known clinical effect of opioids but in the present study similar negative chronotropic effect was exhibited by dexmedetomidine approximately 30–35 minutes after the epidural injection of the drugs. Thereafter, the heart rate remained stable in the range of 56–70/min in both the groups. The requirement of vasopressors for maintenance of stable hemodynamic parameters did not reveal any significant difference between both the groups on statistical comparison. The stable hemodynamic can possibly be explained on the basis of lower volume of local anaesthetics used and a suitable selection of the dose of adjuvant. (11)

Lastly it was observed that there were minimal side effects when dexmedetomidine as compared to fentanyl in the subject population.

Conclusion

Dexmedetomidine is a better additive to epidural surgeries as compared to fentanyl at least in lower limb surgeries. The disadvantage of causing hemodynamic disturbances was easily managed and other benefits outweigh this side effect. The study was on a smaller sample size and further studies on larger samples could provide a better option.

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