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COMPARISON OF CLONIDINE AND FENTANYL AS AN ADJUVANT TO INTRATHECAL 0.5% HYPERBARIC BUPIVACAINE IN PATIENTS UNDERGOING KNEE ARTHROPLASTY

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Abstract

Background and Objective: Fentanyl and clonidine as adjuvants are commonly mixed with 0.5% bupivacaine heavy, by intrathecal route, for prolonging both sensory and motor blockade as well as for enhancing postoperative analgesia in patients undergoing major abdominal or lower limb surgery. This study was undertaken to compare the intraoperative effects and postoperative analgesia of fentanyl and clonidine, used as adjuvant to intrathecal bupivacaine during knee arthroplasty.

Methodology: This prospective, randomized study was conducted on 60 patients of ASA grade I or II, between 20 and 50 years of age divided into two groups of 30 each. The patients were given 3 ml of 0.5% hyperbaric bupivacaine with either 25 mcg of fentanyl (Group F) or 50 mcg of clonidine (Group C) intrathecally. The onset of sensory and motor block, the duration of blockade, hemodynamic parameters, sedation score, total postoperative analgesia time, and side effects if any were recorded.

Results: Both the groups were statistically comparable for demographic data, onset of sensory and motor blockade, duration of blockade and hemodynamic parameters. However, the sedation score was more in clonidine group. The duration of analgesia was significantly prolonged in clonidine group when compared with fentanyl group.

Conclusion: In comparison to fentanyl, addition of clonidine to intrathecal bupivacaine prolongs the duration of postoperative analgesia and cause a higher sedation score.

Keywords: Bupivacaine, clonidine, fentanyl

Introduction

Addition of adjuvants to local anesthetic agents for subarachnoid block causes potentiation of the effect of blockade and also causes prolongation of postoperative analgesia.[1-6] Successful intrathecal use of morphine was first demonstrated by Wang *et al*[7], and since then many opioids have been used as adjuvant to local anesthetic agent. Among all the opioids, fentanyl is most commonly use because of its potency, rapid onset with short duration of action, and comparatively lower incidence of respiratory depression.[3,8] Nevertheless, administration of intrathecal opioids is associated with some side effects[9] such as nausea-vomiting, urinary retention, pruritus and respiratory depression. Hence researches are being done for use of nonopioid adjuvants to local anesthetic agent intrathecally. Intrathecal clonidine has been shown to potentiate the effect of subarachnoid block and to reduce the requirement of local anesthetic agent[10]. Intrathecal clonidine prolongs the postoperative analgesia,[3-5,11,12] and reduces shivering associated with subarachnoid block. Also, it is not associated with side effects seen with the use of intrathecal opioids. In this study we compared clonidine with fentanyl as adjuvant to intrathecal bupivacaine in terms of onset and duration of sensory and motor blockade as well as postoperative analgesia in patients undergoing knee arthroplasty.

Methodology

This prospective, randomized study was conducted on 60 patients of ASA grade I or II, between 30 to 60 years of age, of average height and weight and planned for elective knee arthroplasty under spinal anaesthesia. Exclusion criteria included allergy to study drugs, severe systemic disorders such as hypertension, diabetes mellitus, heart disease, ASA grade more than II, and all common contraindications for spinal anesthesia, such as patient refusal, spine deformity, bleeding disorders, raised intracranial pressure, or infection at the puncture site. The patients were randomized into two groups of 30 each. and were given spinl anaesthesia with 3 ml of 0.5% hyperbaric bupivacaine with either 25 mcg of fentanyl or 50 mcg of clonidine. Premedication consists of inj. glycopyrrolate 0.2 mg IV and inj. ondansetron 4 mg IV. Sedatives were avoided totally, during premedication as well as during operative procedure. On arrival in the operation theatre, basic monitoring parameters such as oxygen saturation, heart rate, ECG and non invasive blood pressure were

recorded. Preloading was done with 10–15 ml/kg of Ringer Lactate. Under all aseptic precautions, subarachnoid block was given with 25 G BD spinal needle (Quincke) in sitting position and depending upon the group, 3 ml of 0.5% hyperbaric bupivacaine with either 50 mcg clonidine or with 25 mcg fentanyl (resulting in total volume of 3.5 ml) were injected intrathecally. Heart rate and blood pressure were monitored and recorded every 5 min. Symptomatic hypotension or bradycardia was treated with mephentermine and atropine, respectively. Sensory block was checked by Pinprick method. Motor blockade was assessed by modified bromage scale. Observations were recorded at different point of time: T_0= time of administration of subarachnoid block, T_1 = time of onset of sensory block, T_2 = time of onset of motor block, T_3 = peak sensory block time, T_4 = time of regression of level of sensory block by 2 segment, T_5 = time of motor block wearing off, and T_6 = time of first postoperative rescue analgesia. Any side effects such as nausea-vomiting, shivering, hypotension, bradycardia, sedation, pruritus and respiratory discomfort if present were recorded. Assessment of sedation was done by Campbell Sedation Score which is graded as (1) wide awake (2) awake and comfortable (3) drowsy and difficult to arouse (4) not arousable. Time of wearing off of sensory blockade was considered at time when regression of pin prick sensation occurred by two dermatomal segments. Wearing off time of motor blockade was considered at point when patient started to lift legs against gravity. Degree of pain was monitored with the visual analogue scale (VAS). Time of wearing off of analgesia was considered when VAS score was >5 and inj. diclofenac 75 mg IV was given as rescue analgesia. All the patients then received inj. Tramadol 100 mg in 100 ml NS, 8 hourly.

Statistical analysis:

Statistical analysis was carried out using student t test, ANOVA, and Chi-square test. $P < 0.05$ was considered statistically significant and p>0.05 as not significant.

Results

In our study, different demographic profile like age, height, weight, gender, and duration of surgery were comparable and statistically not significant ($P > 0.05$) [Table 1].

Table 1: Demographic profile comparison

Characteristics	Group C	Grou p F	P value
Age (years)	45.12± 10.45	44.78± 11.23	>0.05
Height (in cms)	158.12± 5.34	159.67± 5.21	>0.05
Weight(kgs)	63.45± 16.72	62.79± 16.14	>0.05
Gender(M/F)	18/12	17/13	>0.05
Duration of surgery	150.56± 30.67	147.60± 34.50	>0.05

Similarly, there was no statistically significant difference observed in blood pressure and heart rate in both the groups. Hypotension or bradycardia was not observed in any of the patient in both the groups. Table 2 shows the comparison between 2 groups in terms of onset and offset of sensory and motor block and need of rescue analgesia. Both the groups were statistically comparable in terms of onset and regression of sensory blockade, and onset and offset of motor blockade. However the analgesic duration was prolonged in clonidine group as compared to fentanyl group, and the time for requirement of first rescue analgesic dose was significantly longer for clonidine group as compared to fentanyl group ($P < 0.05$).

Table 2: Comparison of onset and regression of sensory and motor block and analgesic duration

Parameters	Group C	Group F	P value
Time to onset of sensory blockade (mins)	0.89± 0.16	0.88± 0.17	>0.05
Time to onset of motor blockade(mins)	1.69± 0.50	1.63± 0.32	>0.05
Time for 2 segment regression of sensory blockade(mins)	173.12± 16.63	169.34±15.78	>0.05
Time of weaning off motor blockade (mins)	210.23± 20.25	216.38±18.82	>0.05
Time of first rescue analgesia (mins)	502.45±120.84	401± 100.70	**<0.05**

In our study, we observed more sedation in clonidine group as compared to fentanyl group. On Campbell sedation score, sedation score of 1 was seen in 4 patients of Group C whereas in 28 patients in Group F. Sedation score of 2 was observed in 20 patients belonging to Group C, and in only 2 patients in Group F. No patient in Group F did show sedation score more than 2, whereas 6 patients in Group C had sedation score of 3. Hence more patients were sedated in clonidine group as compared to fentanyl group and the difference was statistically significant ($P < 0.05$). Table 3 depicts the Campbell sedation scoring system and percentage of patients showing sedation in both the groups.

Table 3: Campbell sedation score and number of patients in both groups

Sedation Score	Group C (%)	Group F(%)
Wide awake	4 (13)	28 (93)
Awake comfortable	20 (67)	2 (7)
Drowsy and difficult to arouse	6 (20)	0 (0)
Not arousable	0 (0)	0 (0)

Apart from sedation, other side effects and complications are shown in Table 4. These were similar in both the groups and not statistically significant ($P > 0.05$)

Table 4: Complications and side effects

Side effects	Group C	Group F
Nausea	1	0
Vomiting	0	1
Hypotension	0	0
Bradycardia	0	0
Pruritis	0	1
Respiratory Depression	0	0
Shivering	2	1

Discussion

Addition of clonidine or fentanyl as adjuvant to intrathecal bupivacaine prolongs the postoperative analgesia. But there are only few studies which have compared these two drugs regarding their effect on sensory and motor blockade and on postoperative analgesia. In this study, we compared 50 mcg clonidine with 25 mcg fentanyl as adjuvant to intrathecal 0.5% bupivacaine heavy in knee arthroplasty in terms of their effect on onset and duration of sensory and motor blockade as well as on postoperative analgesia. Like several previous studies[3-5,13,14], both drugs were found to be effective adjuvant to intrathecal bupivacaine in prolonging the duration of analgesia. Duration of analgesia was significantly prolonged in clonidine group (502.45±120.84 min) than in fentanyl group (401± 100.70 min), ($P < 0.05$). These results were in accordance with the study conducted by Shidhaye RV*et al*[15] and Bajwa BS et al[16] where they found prolonged analgesia in clonidine group as compared to fentanyl group. The increase in duration of post operative analgesia, seen with fentanyl and clonidine in our study, was different from some of the previous studies[3-5,13,14] and that may be due to difference in doses of clonidine, fentanyl, or bupivacaine used in our study.

Systemic side effects such as hypotension, bradycardia or sedation are usually not seen if small dose of intrathecal clonidine or fentanyl are used. Patients in both the groups in our study were hemodynamically stable throughout the procedure with <20% fall in blood pressure. Sethi *et al*[11]and Shah *et al*[12] used 1 mcg/kg of intrathecal clonidine in their study and observed very few incidences of bradycardia or hypotension. Kothari *et al*[4] compared higher dose of intrathecal bupivacaine used alone with lower dose of intrathecal bupivacaine in combination with clonidine and found increased incidence of both hypotension and bradycardia in higher dose bupivacaine group. Biswas *et al*.[17] and Agrawal *et al*[14] observed similar hemodynamic stability with use of 12.5 mcg and 25 mcg of intrathecal fentanyl. In our study, onset and duration of sensory and motor block were comparable in both the groups ($P > 0.05$), but the duration of analgesia was significantly prolonged in clonidine group than in fentanyl group ($P < 0.05$). Sedation scores in our study were higher in clonidine group than in fentanyl group ($P < 0.05$). Similar to our study, Kothari *et al*[4] reported about 40% of patients to be drowsy by addition of 50 mcg of clonidine to bupivacaine. But Bajwa *et al*[5] in their study, did not report any sedation by use of up to 45 mcg of clonidine to intrathecal bupivacaine. This implies that sedative effect of intrathecal clonidine may be dose dependent. In our study, no sedation was observed in fentanyl group and this was in accordance with study conducted by Biswas *et al*[17], Dahlgren *et al*[18], and Hunt *et al*[19].

Conclusion:

Thus our study concludes that addition of 50 mcg clonidine or 25 mcg of fentanyl to intrathecal bupivacaine provides a comparable effect on time of onset and duration of sensory and motor blockade, but clonidine provides a longer duration of postoperative analgesia and a higher sedation than fentanyl. So it is suggested that fentanyl may be a better choice when sedation is not desirable and clonidine may be used when sedation is acceptable.

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