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Postoperative Epidural Analgesia: A Comparative Study between Bupivacaine with Buprenorphine and Bupivacaine with Butorphanol for Lower Limb Orthopaedic Surgeries

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Abstract

Introduction: Pain in the postoperative period produces many physiological and psychological effects. Opioids when combined with local anesthetics for epidural analgesia provide effective pain relief by acting on spinal opiate receptors. They enhance the effect of pain relief and prolong the duration of analgesia. *Aims and objectives*: To compare the effects of Buprenorphine and Butorphanol when added to Bupivacaine for postoperative epidural analgesia with regards to onset and duration of analgesia, hemodynamic variables and sedation scores. *Materials and Methods:* This prospective randomized and double blind observational study was conducted in 100 ASA I and II patients scheduled for lower limb orthopedic surgeries and were randomized into two groups A and B. group A Patients received 8ml of 0.125% Bupivacaine+ 2mcg/ kg of buprenorphine Whereas group B received 8ml of 0.125% of Bupivacaine + 3mcg/kg of butorphanol. Onset and duration of analgesia, sedation, hemodynamic variables and side effects were recorded and compared between the two groups. *Results:* The mean onset of analgesia in group-A was 5.28 min compared to Group-B which was 8.8 min which is statistically significant ($p<0.05$). Duration of analgesia in Group-A was 491.7 min compared to Group- B, which was 338.7min and statistically significant ($P<0.05$). *Conclusion:* We conclude that Buprenorphine added to Bupivacaine provides early onset and prolonged postoperative epidural analgesia compared to epidural butorphanol.

Keywords: Postoperative Analgesia; Buprenorphine; Butorphanol; Visual Analog Scale; Bupivacaine.

Introduction

To prevent postoperative immobilization and prolonged hospitalization, good postoperative analgesia is the need of the hour [1]. Various techniques like local infiltration, intravenous opioids and NSAID's were used for many years but none has proved to be better than epidural analgesia. Initialliy local anesthetics alone were used in epidural space.But over the years various drugs like opioids, alpha-2 agonists like Dexmedetomidine and clonidine, Magnesium sulphate etc were used as adjuvants to local anesthetics. Among the opioids Morphine was the first to be used but owing to its low lipid solubility it produced undesirable side effects as pruritus, nausea, urinary retention and respiratory depression [2]. Among the other opioids Butorphanol has been widely used because of its high lipid solubility.Its use in labour analgesia has been well documented [3,4,5]. Very few authors have studied the effects of buprenorphine in epidural analgesia. So we compared Butorphanol and Buprenorphine added to bupivacaine for postoperative epidural analgesia.

Materials and Methods

This prospective, randomized, double-blinded observational study was conducted in Narayana Medical College, Nellore from April 2017 to January 2018. With informed consent duly signed, 100

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patients aged 20–60 years with American Society of Anesthesiologists (ASA) Physical Status class I–II who were scheduled for lower limb orthopedic surgeries were divided into Group A and group B. patient's who refuse to give consent, with spinal deformities, infection at the site, coagulation abnormalities, sepsis were excluded from the study. All the patients were educated to grade their pain on visual analgesia scale (VAS) scoring pre-operatively.

Group A patients received 8ml of 0.125% Bupivacaine+ 2mcg/ kg of Buprenorphine.

Group B patients received 8ml of 0.125% of Bupivacaine+3mcg/kg of Butorphanol. Fasting guidelines were followed. Alprazolam 0.5 mg orally was given to relieve anxiety on the previous night before the surgery. On the day of surgery in the operation theatre, after securing i.v cannula all the standard monitors like pulse oxymetry,noninvasive blood pressure, Electrocardigram were connected. After preloading the patients with 10ml/kg ringer lactate, under strict aseptic precautions 18G tuohy needle was used to identify the epidural space in L3- 4 space. After identifying the space,epidural catheter was fixed and confirmed the position with 3 ml of Lignocaine with adrenaline as test dose.

3 minutes later, 25G quincke- Babcock's needle was used to acheive spinal anesthesia with 0.5% hyperbaric bupivacaine. Duration of surgeries were less than 2 hours. Epidural analgesia was initiated when when the patients complained of pain and requested for relief in the postoperative period. Group A received 8ml of 0.125% Bupivacaine with Buprenorphine. Group B received 8ml of 0.125% Bupivacaine with of butorphanol. Onset and duration of analgesia were measured. Visual analog scores, hemodynamic parameters and sedation scores were measured till 10 hours postoperatively. Onset of analgesia was taken as time duration between injection of drug and onset of pain relief. Duration of analgesia was calculated as the time between the first analgesic dose and till the patient complained of pain. Patients were asked to locate the intensity of pain on the visual analogue scale. Zero end of the scale was taken as 'No pain' and 10 cm mark as 'Maximum pain'. Intensity of pain increases gradually from '0' to '10'. Sedation was assessed by Ramsay sedation score. Side effects like nausea, vomiting, hypotension, respiratory depression and somnolence, pruritus, allergic reactions were noted.

Statistical Analysis

All recorded data were entered using MS Excel software and analyzed using SPSS 20 version software for determining the statistical significance. Results were shown as mean±standard deviation. Proportions were compared using Chi-square test. Statistical difference between both the study groups was determined by student 't' test. $p < 0.05$ was taken as statistically significant, p value of <0.01 has high statistical significance and p value of <0.001 was considered as extremely statistically significant.

Results

Both the groups were demographically comparable as the difference was not statistically significant ($p > 0.05$) (Table 1).

Mean onset of analgesia in Group-A was 5.28mins which was significantly earlier when compared to Group-B which was 8.84mins ($p<0.05$) (Table 2) (Figure 1).

Table 1: Demographic data

Demographic Variables among the groups	Group A	Group B	p Value
Age in years (mean ± SD)	34.1812.13	34.87±10.12	0.964
Height in cms (mean ± SD)	168.88±66	164.32±2.10	0.53
Weight in kgs (mean ± SD)	60.45±3.26	63.32±7.22	0.43
Gender (M/F)	26/24	27/23	0.34

Table 2: Mean Onset of Analgesia

	No. of patients	Mean onset of analgesia (in min)	SD	p value
Group A	50	5.28	1.12	$p < 0.05$
Group B	50	8.84	2.03	

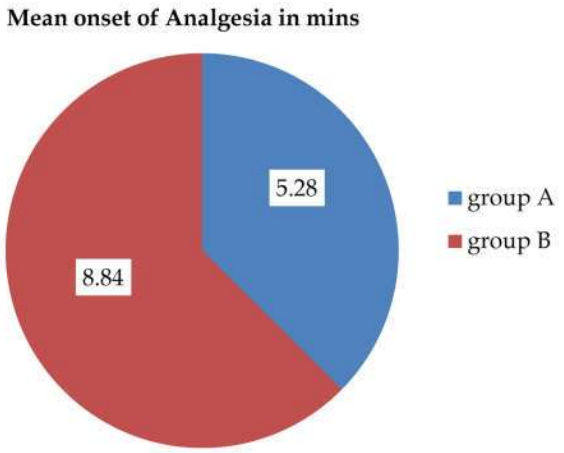

Fig. 1: Mean onset of analgesia

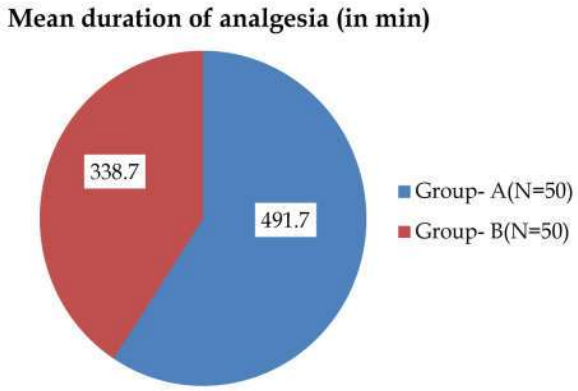

Fig. 2: Mean duration of analgesia

Table 3: Mean duration of analgesia

	No. of patients	Mean duration of analgesia (in min)	SD	P value
Group A(N=50) (Buprenorphine +Bupivacaine group)	50	491.7	91.58	P < 0.05
Group B(N=50) (Butorphanol + Bupivacaine group)	50	338.7	84.09	

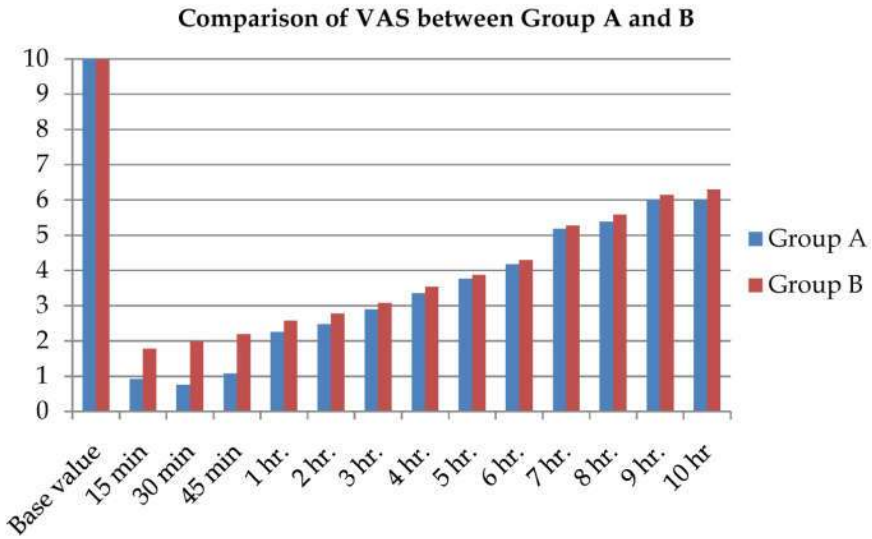

Fig. 3: Comparison of VAS scores between Group A and B

Mean duration of analgesia in Group-A was 491.7min compared to Group-B which was 338.7min. Which was significant statistically ($p<0.05$). (Table 3, Figure 2)

There was statistically significant difference in VAS between group A and group B at 15 min, 30 min and 45min. VAS score was very low in group A compared to group B. It indicates good pain relief with Buprenorphine compared to butorphanol. (Figure 3).

Sedation scores at 15min, 30min 45mins and 1hr were low in Group B compared to group A which was statistically significant (Table 4).

There was no statistically significant difference between both the groups with regards to hemodynamic variables and side effects (Table 5).

Table 4: Sedation scores

Time interval	Group A		Group B		p value
	Mean	SD	Mean	SD	
Base value	4.920	0.634	4.820	0.438	0.361
15 min	2.500	0.789	1.600	0.670	**0.000***
30 min	3.020	0.622	1.740	0.694	**0.000***
45 min	4.120	0.521	1.960	0.755	**0.000***
1 hr.	4.760	0.687	2.540	0.762	**0.000***
2 hr.	4.700	0.505	4.600	0.808	0.460
3 hr.	4.740	0.443	4.780	0.679	0.728
4 hr.	4.860	0.452	4.958	0.651	0.386
5 hr.	5.020	0.428	5.000	0.459	0.833
6 hr.	5.082	0.277	5.179	0.670	0.375
7 hr.	5.024	0.517	5.154	0.555	0.440
8 hr.	5.273	0.674	5.286	0.488	0.962
9 hr.	5.304	0.635			
10 hr	5.417	0.515			
>10 hr	6.000	0.000			

Table 5: Incidence of side effects

Side effects	Group-A (Buprenorphine +Bupivacaine group)	%	Group-B (Butorphanol + Bupivacaine group)	%
Nausea and vomiting	5	10	12	24
Urinary retention	2	4	6	12
Pruritus	8	16	4	8
Hypotension	0	0	0	0
bradycardia	0	0	0	0

Discussion

Postoperative pain relief has been the worrisome factor for the patients, surgeons and even anaesthesiologists. Various modalities like local surgical incision site infiltration, intramuscular injections, intravenous opioids etc were used for many years and still being used though none of them proved to be superior to Epidural analgesia. When local anesthetics alone were used to provide analgesia, the quality and duration of analgesia was not satisfactory. So various adjuvants like opioid, magnesium, Dexmedetomidine and clonidine etc were tried to improve the quality and prolong the duration of analgesia. Opioids as adjuvants to local anaesthetics for epidural analgesia reduces the doses and concentrations of local anesthetics required to achieve excellent analgesia [6,7]. Opioids in the epidural space produces long duration of pain relief, early mobilisation, and lower risk of postoperative venous thrombosis [8].

Pruritus, nausea, vomiting, respiratory depression, urinary retention are the well-known side effects of intrathecal and epidural opioids which precludes the anesthesiologists from using [9]. Delayed respiratory depression is one of the dangerous complication which is commonly seen with opioids like morphine which is due to its low lipid solubility [10].

Buprenorphine which is more lipid soluble than morphine is also 25-40 times more potent than it. It is a semi-synthetic opioid which has agonist activity at the μ-receptor, partial or full agonist activity at the δ-receptor, and competitive antagonist activity at the k-receptor [11] It also has a long half-life.

Butorphanol is a synthetic agonist-antagonist opioid drug. It is a nitrogen-substituted 3,14-dihydroxymorphinan. Butorphanol is a potent analgesic with both opioid agonist and antagonist effect. Butorphanol and its major metabolites are agonists at kappa-opioid receptors and mixed agonist-antagonists at mu opioid receptors [12].

Wolff et al. observed that epidural buprenorphine (0.3.g) provided long duration of action (620mins) compared to epidural morphine 4mg (580 min) for postoperative pain relief after major orthopedic

surgery. The results were similar to our study [13]. Bharti and Chari in their study found that the duration of analgesia with 2 mg of epidural butorphanol was 4.35±0.66 h whose results were akin to our study [14].

In our study we compared 2μ/kg buprenorphine and 3μ/kg butorphanol added to 0.125% Bupivacaine for postoperative analgesia. Onset of analgesia was faster in Group A (5.28 mins) compared to Group B (8.84) ($p<0.001$).

Duration of analgesia was significantly prolonged in Buprenorphione group (491 mins) compared to butorphanol group (338mins). VAS scores were better in group A. Sedation scores were higher in group B which was not desirable. Side effects were comparable in both the groups.

Conclusion

We conclude that epidural Buprenorphine is a better alternative to epidural butorphanol along with Bupivacaine as it provides faster onset and prolonged duration of analgesia with lower sedation scores and fewer side effects .

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