Clinical Comparative Evaluation of Bupivacaine with Fentanyl and Ropivacaine with Fentanyl in Upper Limb Surgery Under Supraclavicular Brachial Plexus Block

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Abstract

Introduction: A lot of surgeries are now performed to reduce a number of physical ailments. Although these surgeries are done to reduce the sufferings these inevitably lead to a lot of pain for the patient.

Material and Methods: Our study comprises of 60 patients who had undergone elective upper limb surgery in a tertiary care centre of central India. Patients of both genders, in age group 18-60 years with American Society of Anaesthesiology (ASA) grade I or II were included in our study and divided in two groups of 30 each.

Results: Data was entered into MS-Excel sheet and analysed by SPSS version 20. Quantitative data was compared by using student t-test and qualitative data by using chi-square test and Fisher exact test, as applicable. $P \leq 0.05$ was considered as statistically significant. Both the groups were similar in demographic and surgical characteristics. However, we found that the group given bupivacaine and fentanyl had longer duration of sensory and motor block and post-operative analgesia than ropivacaine and fentanyl group ($p<0.001$).

Conclusion: Combination of bupivacaine with fentanyl provides longer duration of sensory block, motor block and postoperative analgesia without any major side effects than combination of ropivacaine with fentanyl with comparable haemodynamic in both groups.

Keywords: Brachial plexus; bupivacaine, ropivacaine, fentanyl.

Introduction

Pain is defined as an unpleasant sensory and emotional experience associated with, or resembling with, which is associated with, actual or potential tissue damage. It is a sensory signal carried via nerves to higher centres in Central Nervous System. This signal can be modified and interrupted anywhere along the nerve's pathway [1]. The surgeries which are done to reduce pain and suffering also inevitably lead to a lot of pain.

Increased stress response is seen in patients experiencing pain during and after surgeries. This response may lead to increased hospital stay, wound infections, morbidity and mortality. Pain also causes immobility which may lead to deep vein thrombosis, bed sores, pulmonary embolism, etc[2]. Now due to unique pharmacologic properties like less Cardiotoxicity and neurotoxicity Ropivacaine is being preferred by an increasing number of anaesthesiologists for peripheral nerve blocks[3]. This type of block mainly avoids the untoward effects of general anaesthesia like the upper airway instrumentation and mainly helps in achieving ideal operating conditions by producing muscular relaxation, maintaining stable intraoperative hemodynamic condition and sympathetic block which reduces postoperative pain, vasospasm and edema, analgesia, and shortened hospital stay and reduced side effects[4]. Fentanyl is synthetic opioid agonist that is structurally related to meperidine. It was synthesized by Janssen pharmaceutical[5]. Successful regional anaesthesia depends on accurate deposition of local anaesthetic around nerves. Previous techniques like eliciting paraesthesia or peripheral nerve stimulator were dependent on surface landmarks for accurate drug deposition. Thus, these techniques were limited by anatomical and physiological variations and equipment accuracy.

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To overcome these shortcomings Ultrasound (USG) guided regional anaesthesia is increasingly preferred.

Material and Methods

The present study from February 2018 to August 2019 was conducted on 60 cases prospectively in patients admitted to our tertiary care centre, undergoing elective upper limb surgery. The patients were randomly allocated into 2 groups of 30 each i.e.

Group I: Patients receiving 0.5% bupivacaine (25ml) + fentanyl 1mcg/kg (diluted to 2 ml) and Group II: Patients receiving 0.5% Ropivacaine (25ml) + fentanyl 1mcg/kg (diluted to 2 ml).

Under all strict aseptic precautions, patients were given USG guided Supraclavicular brachial plexus block with any one of the study drugs.

Selection criteria

Patients belonging to age group 18-60 years with ASA grade I and grade II undergoing elective operative procedure for upper limb surgeries were included in the study while patients with history of bleeding disorders, local infection at the site of block, hypertension and heart blocks, known allergy to local anaesthetics, and any of the study drugs were excluded from the study.

Data were entered in MS-Excel sheet and analysed by SPSS version 20. Descriptive statistics were represented with percentages; Mean with SD depends on nature of the data. Quantitative data was compared with help of student t test. Qualitative data was compared with chi square test and Fisher exact test. $P \leq 0.05$ was considered as statistically significant.

Results

Table 1: Demographic distribution of study subjects

Gender	Group I	Group II	TOTAL	Chi Square Value	p-Value
Male	20	14	34	2.443	0.118(NS)
Female	10	16	26		
ASA Grade					
Grade I	20	16	36	1.111	0.292(NS)
Grade II	10	14	24		
TOTAL	30	30	60		
Mean Age	36.66±11.59 Year	34.30±9.04 Year		0.879	0.382(NS)
Mean Weight	51.60±6.85 kg	51.10±6.18 kg		0.296	0.767(NS)

Table 1 - Shows demographic distribution of study subjects. Out of 60 patients, randomly 30 were given bupivacaine with fentanyl and 30 were given ropivacaine with fentanyl. Out of 60 patients, 34 were male and 26 were female. Out of 60 patients, 36 were having ASA Grade I and 24 were having ASA grade II. There was no statistically significant difference found in distribution of study subjects. (p>0.05)

Table 2: comparison of VAS score in two groups

Groups	VAS Score				
	30 min	60 min	90 min	120 min	150 min
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Group I	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Group II	0.00±0.00	0.00±0.00	0.00±0.00	0.033±0.182	0.233±0.430
Student 't' Test Value	NA	NA	NA	1.000	2.971
P-Value	NA	NA	NA	0.321(NS)	0.004 (HS)

Table 2 - Shows comparative evaluation of mean VAS score between group I and group II at different time intervals. Till, 90 minutes follow up, there was no pain then at 120-minute pain was noticed only in group II patients. Mean VAS Score was 0.033±0.182 in group II patients at 120 minute and 0.233±0.430 at 150 minute respectively. At 150 min there was statistically significant difference in mean VAS Score between group I and group II at 150 min. (P=0.004)

Table 3: Comparison of onset of sensory blockade between two groups

Groups	Mean onset of sensory block (Min)	
	Mean	SD
Group I	8.767	1.65
Group II	6.800	1.15
Student 't' Test Value	5.336	
P-Value	0.001(HS)	

Table 3 shows comparative evaluation of mean time of onset of sensory block between group I and group II. There was statistically highly significant difference found in mean time of onset of sensory block between group I and group II (P=0.001).

Table 4: comparison of duration of sensory blockade between two groups

Groups	Mean duration of sensory block (Min)	
	Mean	SD
Group I	684.300	31.92
Group II	568.167	77.03
Student 't' Test Value	7.628	
P-Value	0.001(HS)	

Table 4 shows comparative evaluation of mean duration of sensory block between group I and group II. There was statistically significant difference found in mean duration of sensory block between group I and group II (P=0.001).

Table 5: Comparison of onset of motor blockade between two groups

Groups	Mean onset of motor block (Min)	
	Mean	SD
Group I	14.467	1.92
Group II	11.067	1.43
Student 't' Test Value	7.753	
P-Value	0.001(HS)	

Table 5 shows comparative evaluation of mean time of onset of motor block between group I and group II. Mean time of onset of motor block was more in group I patients as compared to group II patients. There was statistically significant difference found in mean Time of onset of motor block between group I and group II(P=0.001).

Table 6: Comparison of duration of motor blockade between two groups

Groups	Mean duration of motor block (Min)	
	Mean	SD
Group I	495.833	92.76
Group II	402.833	93.21
Student 't' Test Value	3.873	
P-Value	0.001(HS)	

Table 6 shows comparative evaluation of mean duration of motor block between group I and group II. Mean duration of motor block was more among group I patients as compared to group II patients. There was statistically highly significant difference found in mean duration of motor block between group I and group II (P=0.001).

Table 7: Comparison of rescue analgesia between two groups

Groups	Mean time of rescue analgesia (Min)	
	Mean	SD
Group I	990.53	138.51
Group II	826.0	114.10
Student 't' Test Value	6.547	
P-Value	0.001(HS)	

Table 7 shows comparative evaluation of mean time of rescue analgesia between group I and group II. Mean time of rescue of analgesia was significantly more in group I patients as compared to group II patients. There was statistically highly significant difference found in mean time of rescue analgesia between group I and group II (p=0.001).

Discussion

Brachial plexus block is an easy and relatively safe procedure for upper limb surgeries. Various approaches like supraclavicular, interscalene, infraclavicular and axillary have been used for blocking the brachial plexus. Supraclavicular approach to Brachial plexus block is associated with rapid onset and reliable anaesthesia. Hence it is one of the most popular techniques used for upper limb blocks. Currently available local anaesthetics can provide analgesia for limited period of time when used as single injection. To extend the analgesia period beyond the operating rooms, various methods have been tried with the aim of prolonging the local anaesthetic action, like continuous infusion of local anaesthetics via indwelling catheters, use of combination of anaesthetics increasing the volume of LA, addition of different adjuvants in local anaesthetics[6].

Of various LA s, Lignocaine and Bupivacaine are the most frequently used, however there are limitations like shorter duration of action (Lignocaine) and increased incidence of Cardiotoxicity (Bupivacaine). To overcome these limitations, newer LA like Ropivacaine has been introduced which is less cardiotoxic and CNS toxic than Bupivacaine. But combination of bupivacaine and fentanyl provides longer duration of sensory block, motor block and postoperative analgesia than combination of ropivacaine and fentanyl.

Increasing the volume (dose) of LAs may prolong the duration of analgesia, but may also increase the risk of LA systemic toxicity. Although variety

of perineural adjuvants, including Buprenorphine, Fentanyl[7]. Tramadol, Clonidine, Dexmedetomidine, Dexamethasone, Magnesium, and Midazolam[8] have been used to prolong the duration of analgesia of nerve blocks with varying degrees of success. Modak et al[9]., used 30 ml of 0.5% ropivacaine and 0.5% bupivacaine and concluded that ropivacaine had earlier onset of sensory block as compared to bupivacaine. Rajkhowa et al[10]., conducted a study using 30 ml of 0.5% ropivacaine alone and 30 ml of 0.5% ropivacaine plus 50 µg of fentanyl. They concluded that, addition of fentanyl to ropivacaine delayed the onset of analgesia or sensory block, which is in accordance with our study.

Kaur et al[11]., conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5% ropivacaine. They concluded that duration of sensory block was greater in bupivacaine group as compared to ropivacaine group. Barsagade et al[12]., conducted a study using 30 ml of 0.5% bupivacaine plus fentanyl 1µg/kg and 30 ml of ropivacaine 0.5% plus 1µgm/kg of fentanyl and found that the duration of sensory block in bupivacaine group was longer. Modak et al[9]., conducted a study using 30 ml of 0.5% bupivacaine and ropivacaine in 60 patients posted for upper limb surgeries and concluded that ropivacaine has earlier motor onset. Barsagade et al[12]., conducted a study using 30 ml of 0.5% bupivacaine plus 1µg/kg fentanyl and 30 ml of 0.5% ropivacaine plus 1µg/kg fentanyl and concluded that bupivacaine has greater duration of motor block as compared to ropivacaine, which is similar to our study.

Kaur et al[11]., conducted a study using 30 ml of 0.5% bupivacaine and 30 ml of 0.5% ropivacaine and found that the duration of motor block was greater in bupivacaine group. Venkatesh et al[13]., observed no statistically significant changes in the heart rate, blood pressure and saturation in the study groups. Barsagade et al[12]., conducted a study using 30 ml of 0.5% bupivacaine plus 1µg/kg fentanyl and 30 ml of 0.5% ropivacaine plus 1µg/kg fentanyl and concluded that the requirement of rescue analgesia was earlier in ropivacaine group as compared to bupivacaine group, which is similar to our study. Barsagade et al[12]., observed no significant side effects in both the study groups.

Conclusion

In conclusion, combination of bupivacaine and fentanyl provides longer duration of sensory block, motor block and postoperative analgesia then combination of ropivacaine and fentanyl with comparable haemodynamic in both the study groups and without any major complications.

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Conflict of interest: Nil
Source of funding: Nil

Date received: Jul 31, 2021
Date accepted: May 27, 2022