Original Research Article

A comparative study of fentanyl versus dexmedetomedine as adjutants to ropivacaine in supraclavicular brachial plexus block in patients undergoing elective upper limb surgery: A Double-blind, Prospective, and Randomized Study

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Abstract

Introduction: Brachial plexus block is the most commonly used method of anaesthesia for upper limb surgeries. Various types of local anaesthetics and adjuvants are used to provide block. But there are very few studies comparing fentanyl and dexmedetomedine as adjuvants to ropivacaine in brachial plexus block. So we decided to carry out a comparative evaluation of two drugs for their adjuvant use with ropivacaine in supraclavicular block among patients undergoing upper limb orthopedic surgeries.**Settings and design:** This was a prospective, randomized, double-blinded study.**Methods:** The patients were randomly divided into two groups of 40 each using computerized randomization table. Group A (R+F) patients received 30 ml of 0.5% ropivacaine with 1 μg/kg of fentanyl diluted with normal saline (NS) to make a total volume of 35 ml. Group B (R+D) patients received 30 ml of 0.5% ropivacaine with 1 μg/kg of dexmedetomidine diluted with normal saline to make a total volume of 35 ml. **Results:**Mean motor and sensory block onset time and degree of block was similar in both groups, while mean duration of sensory and motor block and total duration of analgesia was more in Group B(R+D) compared to group A(R+F). Level of sedation in post op was more in group B.**Conclusion:** The upper limb surgeries performed under the influence of supraclavicular block with .5% ropivacaine and dexmedetomidine 1 μg/kg as an adjuvant is highly effective in prolonging the duration of sensory and motor blockade and duration of analgesia with better quality of block as compared to 0.5% ropivacaine with fentanyl (1μ/kg).

Keywords: Analgesia; brachial plexus; bupivacaine; dexmedetomidine; fentanyl; ropivacaine.

Introduction

Supraclavicular approach is the easiest technique and most consistent method for anesthesia and analgesia in surgeries below the shoulder joint. It has the reputation of providing most complete and reliable anaesthesia for upper limb surgery. It is performed at the trunk level where the plexus is presented most compactly. This anatomic compactness is responsible for complete and reliable anaesthesia [1].Various local anaesthetics (LAs) such as lignocaine and bupivacaine [2] have been used for administering the blocks frequently, due to longer duration of action as well as better neuronal block (sensory to motor). Ropivacaine, a newer amino-amide local anaesthetic, has been increasingly used now days in different concentration for peripheral nerve blocks. It has lesser CVS and CNS toxicity and higher safety margin when compared to bupivacaine[3].. Well tolerated for postoperative analgesia and reduced cardiovas-cular and neurological toxicity[4].Local anaestheticsalone have limited duration of action and high doses are required when thinking about optimal post operative analgesia so various adjutants such as epinephrine,Sodium bicarbonate,Dexamethsone,Fentanyl, Dexmedeto-midine[5-9] were added to local anaesthetics in brachial plexus block to achieve quick, dense and prolonged block, but the results are either inconclusive or associated with side effects.Dexmedetomidine and fentanyl are twoof the several adjuvant drugs. There are limited or meagre studies which compares theuse of ropivacaine with fentanyl to ropivacaine with dexmedetomidine.

Dexmedetomidine is a relatively selective α-2 adrenergic agonist that has been used for premedication and as an adjunct for general and regional anaesthesia. Adding dexmedetomidine to local anaesthetics during peripheral nerve blockade may also prove efficacious for the surgical patient[10].

Fentanyl-a synthetic opioid has been shown to prolong analgesia from axillary brachial plexus blocks with lignocaine and bupivacaine. Fentanyl can act directly on PNS. Primary afferent tissues (dorsal horn) have been found to contain opioid binding sites. Because the presence of bidirectional axonal transport of opioid binding protein has been shown, fentanyl may penetrate the nerve membrane and act at dorsal horn leading to prolonged analgesia. Fentanyl can potentiate local anesthetic action via central opioid receptor-mediated analgesia by peripheral uptake of fentanyl to systemic circulation[11]Considering the low side effect and excellent postoperative analgesic efficacy of two drugs, it is essential to carry out a comparative evaluation of two drugs for theiradjuvant use with ropivacaine in supraclavicular block among patients undergoing upper limb orthopaedic surgeries.

Primary objectives

1.To study and Compare onset of action, degree and duration of sensory block.

2.To study and compare onset of action, degree and duration of motor block.

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Secondary Objectives

1.To study and compare duration of analgesia.

2.To study and compare side effects and complications like nausea, vomiting, bradycardia, hypotension.

Materials and methods

Study design and participants

Prospective randomized double-blind study was conducted in the Department of Anaesthesia, Government R.D.B.P. Jaipuriya Hospital (Attached with RUHS CMS), Jaipur. After taking permission from the institutional ethical committee 80 patients included in the study.

Inclusion criteria:

1. Patients of either sex.
2. Age group 18-60 years.
3. Body weight 40 to 70 kg.
4. Patients undergoing elective major orthopaedic surgery on upper limb which takes 1-3 hours duration.
5. Patients belonging to ASA class-I and II.

Exclusion criteria:

1. Uncooperative patients.
2. Patient with Local pathology at the site of injection or disability limiting the performance of block.
3. Patient with History of convulsion, bleeding disorder, severe neurological deficit.
4. Patient with Allergy to the drugs used in study.
5. Lack of patient's consent.
6. Patients with anticipated difficult intubation: Mallampati Grade III and IV.
7. Any other co morbidities (chronic obstructive pulmonary disease, ischemic heart disease, hypertension, diabetes mellitus, renal/hepatic dysfunction, etc.).
8. Morbid obesity (body mass index >35)

Sample size: Sample size calculated using the following formula

$$n = (Z_{\alpha/2}+Z_{\beta})^2 * 2*\sigma^2 / d^2$$

Mean in fentanyl group-mean duration of block was >6 hr (369.4 ± 36.9 min) (based on study done by Nyla Farooq et al)[12]Mean in dexmedetomidine group- mean duration of block was < 6 h (323.7 ± 48.1) (Based on study done by Nyla Farooq et al)

n -Sample Size

σ-Standard deviation of within pair difference= 48

d-Clinically meaningful difference =45.7

Zβ-Corresponds to power (.84 = 80% of power)

Zα/2-Corresponds to two - tailed significance (1.96 for alpha =.05)

Sample size of 36 case required in each group at 80% study power and alpha error 5%. So we had taken 40 cases in each group for present study expecting approximate 10% drops out.After obtaining clearance from the Hospital Ethical Committee, 80 patients in the age group of 18–60 years scheduled for upper limb orthopaedic surgeries under brachial plexus block were included in this study.The patients were randomly divided into two groups of each of 40 patients by computer generated random numbers. This was done and the medications were prepared by another person so that patient and the person doing the study do not know in which group a particular patient has been allotted.

Group A (Ropivacaine + Fentanyl) (R+F)(n=40) received 30 ml of 0.5% ropivacaine & 1mcg/kg body weight Fentanyl.

Group B (Ropivacaine + Dexmedetomedine) (R+D) (n=40) received 30 ml of 0.5%ropivacaine& 1mcg/kg body weight dexmedetomidine hydrochloride.All the solutions were diluted with isotonic normal saline to make a total volume of 35 ml.

The patients were visited a day before surgery for preanesthetic review and standard institutional preoperative advice.

Informed consent was obtained from all the patients enrolled in the study and asked to remain nil orally 6 h before surgery.

On the day of surgery, all patients after evaluation were taken to the operation theatre. Monitors were attached and baseline parameters (heart rate [HR], blood pressure [BP], SpO_2, and electrocardiogram) were recorded. Intravenous access was secured. Patients did not receive any premedication. However perioperative sedation was achieved by using inj. Midazolam 1 mg iv if needed. The patients were placed in the supine position, with the head turned away and the ipsilateral arm adducted. The interscalene groove and mid-point of the clavicle and subclavian artery were identified. After aseptic preparation of the area, at a point 1.5 to 2.0 cm posterior to midpointof the clavicle a skin wheal was raised with a local anaesthetic (lignocaine 2% plain). Next, a 22G, 50 mm "short bevelled" needle was passed through the same point in a caudal, slightly medial and posterior direction, until either a paresthesia is elicited or the first rib is encountered. If the first rib is encountered, the needle was moved over the first rib until a paresthesia is elicited either in the hand or arm. After eliciting paresthesia and negative aspiration of blood, the study medications were injected.After performance of nerve block patients were evaluated for onset of sensory block every 1 minute. The sensory block was assessed by pin prick with 25 gauge needle.Heart rate, non-invasive blood pressure and SPO2 and sedation score were measuredevery 5 minutes for first half an hour and thereafter every 15 minutes. Postoperatively heart rate, non-invasive blood pressure and pain and motor power & sedation score were recorded at 0 min, 30 min, 1hr, 3hrs, 6hrs, 12hrs and 18hrs.

Sensory block: Assessed using Pin Prick Method[13]

0 - Sharp pain.

1 - Touch sensation only.

2 - Not even touch sensation.

Table 1:Motor Block: **Assessed using Modified Bromage scale[14]**

Grade	Criteria	Degree of block
0	Able to raise the extended arm to 90^0 for a full 2 sec	Nil (0%)
1	Able to Flex the elbow and move the fingers but unable to raise the extended arm	Partial (33%)
2	Unable to flex the elbow but able to move the fingers	Almost Complete (66%)
3	Unable to move the arm , elbow or fingers	Complete (100%)

Sedation Score(Modified Ramsay sedation Scale)[15]

1. Anxious,Agitated, restless
2. Cooperative, Oriented, Tranquil
3. Response to Command Only
4. Brisk response to light glabeller tap or loud noise
5. Sluggish response to light glabeller tap or loud noise
6. No response

Visual Analogue Scale used to assess post operative pain[16]

Score 0 : No pain

Score 1, 2, 3 : Mild pain

Score 4, 5, 6 : Moderate pain

Score 7, 8, 9 : Severe pain

Score 10 : Worst Imaginable pain

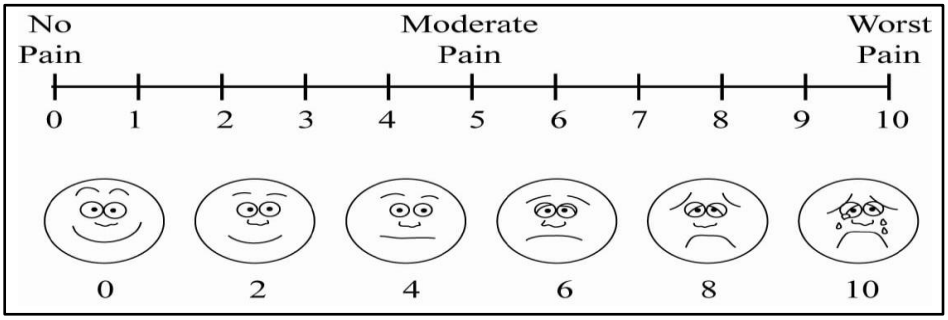

Fig 1: showing visual analogue scale

Hypotension (defined by decrease in mean arterial pressure below 20% of the baseline or systolic BP [SBP] <90 mmHg) was treated with injection mephentermine 6 mg/ml.Bradycardia (HR <50 bpm) was treated with injection atropine 0.6 mg/ml.Respiratory depression (RR <8 bpm or SpO_2 < 95%) was treated with oxygen supplementation and respiratory support if required.Postoperatively, time for first rescue analgesic was also noted and injection Diclofenac 75mg i.v. was given as rescue analgesic.

Statistical analysis:Statistical analysis were done using computer software (SPSS Trial version 23 and primer). The qualitative data were expressed in proportion and percentages and the quantitative data expressed as mean and standard deviations. The difference in proportion was analysed by using chi square test and the difference in means among the groups was analyzed using the student T Test Significance level for tests were determined as 95% (P< 0.05).

Result

The present study was carried out with the aim to compare the efficacy of fentanyl and dexmedetomidine as adjutants to ropivacaine for brachial plexus block among patient undergoing upper limb orthopaedic surgeries.

Table 2: Demographic profile and general characteristics

Variable	Mean±SD		P Value
	R+F	R+D	
Age (years)	40.05±11.72	38.25±12.76	0.513
Weight (kg)	64.98±6.99	63.10±8.68	0.29
ASA Grade (I:II)	39:1	38:2	1.00
Male:Female	28:12	27:13	1.00

SD: standard deviation, ASA: American Society of Anaesthesiologist, P value <0.05: significant

Table 2 compares the baseline demographic and general characteristics of patients in two groups.

Table 3: Time taken for onset of sensory and motor block (in mins)

	R+F		R+D		Total		
	Mean	SD	Mean	SD	Mean	SD	P Value
Onset of sensory block	7.2	5.4	6	1.8	6.6	4.2	0.12
Onset of motor block	14.64	10.26	14.22	8.94	14.46	9.6	0.86

SD: standard deviation, P value <0.05: significant

Table 3 depicts the distribution of cases according to onset of sensory and motor block. There was no statistically significant difference in mean time to onset of sensory (p value 0.12) and motor block (p value 0.86) in both groups.

Table 4: Grade of sensory block

	R +F		R+D		Grand Total	
Grade of sensory block	No	%	No	%	No	%
1	3	7.5	2	5	5	6.25
2	37	92.5	38	95	75	93.75
	40	100	40	100	80	100

Chi-square = 0.000 with 1 degree of freedom; P = 1.000

Table 4 depicts the distribution of cases according to grade of sensory block. There was no statistically significant difference in grade of sensory block in both the groups (p 1.0). 93.75% falls under grade 2 of sensory block followed by 6.25% falls under grade 1of sensory block and same pattern was observed in both the groups.

Table 5:Grade of motor block

	R +D		R+F		Grand Total	
Grade of motor block	No	%	No	%	No	%
2	3	7.5	5	12.5	8	10
3	37	92.5	35	87.5	72	90
Total	40	100	40	100	80	100

Chi-square = 0.139 with 1 degree of freedom; P = 0.709

Table 5 depicts the distribution of cases according to grade of motor block. There was no statistically significant difference in grade of motor block in both the groups (p 0.709). 90% falls under grade 3 of motor block and 10% under grade 2 of motor block and almost same pattern were observed in both the groups.

Table 6:Duration of sensory block and motor block (in minutes)

	Sensory block			Motor block		
	N	Mean±SD	P Value	N	Mean±SD	P Value
R+D	40	235.8±57	0.02	40	279±63.6	0.001
R+F	40	210±40.2		40	232.2±57	
Total	80	220.2±49.8		80	255.6±64.2	

SD: standard deviation, P value <0.05: significant

Table 6 depicts the mean time of duration of sensory block was higher in group R+D(235.8±57mins) followed by group R +F (210±40.2min) P(0.02). Mean duration of motor block was less in group R+F(232.2+57 min) than group R+D (279+63.6) which was significant p(0.001).

Table 7:Duration of analgesia

	N	Mean	SD	P value
R +D	40	356.13	19.66	<0.001
R+F	40	301.75	14.87	
Total	80	328.94	32.38	

SD: standard deviation, P value <0.05: significant

Table 7 depicts the duration of analgesia among the groups. The mean duration of analgesia was less in group R+F (301.75±14.87mins) followed by group R+D (356.13±19.66min) P<0.001.

Table 8:Baseline hemodynamic parameters

		PR (beats/min)	SBP(mm of Hg)	DBP(mm of Hg)	RR(breaths per min)	SpO2 in %
R +D	N	40	40	40	40	40
	Mean	79.53	124.10	77.73	14.00	100.00
	SD	8.21	9.62	6.81	0.00	0.00
R+F	N	40	40	40	40	40
	Mean	76.80	125.70	77.70	14.00	100.00
	SD	7.99	9.04	5.46	0.00	0.00
Total	N	80	80	80	80	80
	Mean	78.16	124.90	77.71	14.00	100.00
	SD	8.164	9.306	6.136	0.000	0.000
P Value		.136	.445	.986	NA	NA

SD: standard deviation, P value <0.05: significant

Table 8 shows the comparison of baseline hemodynamic variables- heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) & mean arterial pressure (MAP) among both groups. The values were comparable among two groups.

Intra Operative Haemodynamic Analysis

Table 9: Intra Operative Mean Heart Rate (Beats/minute), Mean systolic and Diastolic BP(mmHg)at various time intervals

	Mean Diastolic BP(mm of Hg)			Mean Heart Rate(Beats/min)			Mean systolic BP(mm of Hg)		
	Group R+F Mean±SD	Group R+D Mean±SD	P value	Group R+F Mean±SD	Group R+D Mean±SD	P value	Group R+F Mean±SD	Group R+D Mean±SD	P value
Baseline	78.46±5.29	79.69±5.31	0.187	73.20±6.55	74.65±4.44	0.143	119.54±8.01	122.09±8.20	0.075
0	78.66±5.53	76.69±5.63	0.069	74.86±6.47	73.63±5.45	0.243	119.51±7.50	118.43±6.72	0.390
5	78.02±5.69	78.48±5.67	0.644	74.40±6.38	76.25±5.30	0.074	119.54±8.46	119.29±5.93	0.847
10	78.35±6.08	76.51±5.84	0.079	74.80±6.84	74.65±5.42	0.880	119.60±8.02	119.00±6.21	0.634
15	77.86±6.91	75.57±6.17	0.052	74.69±7.04	72.85±5.30	0.093	118.78±7.77	117.91±6.62	0.489
20	78.46±6.61	74.25±6.48	0.0003	74.02±6.95	71.78±5.54	0.045	118.38±7.02	115.98±6.71	0.048
25	77.98±7.05	73.23±7.15	0.0002	74.28±6.56	70.68±5.88	0.001	118.88±6.91	115.63±7.33	0.010
30	77.83±7.11	72.60±7.22	<0.001	74.37±6.92	69.65±6.11	<0.001	118.06±6.74	113.94±7.68	0.001
45	77.42±6.28	71.91±7.23	<0.001	74.65±6.64	68.62±6.15	<0.001	117.97±6.95	113.80±7.40	0.001
60	78.28±5.94	71.15±7.11	<0.001	74.94±6.21	68.09±6.31	<0.001	117.82±6.27	114.02±6.86	0.001
75	78.30±5.93	72.32±7.45	0.0006	75.37±6.28	66.97±6.25	<0.001	117.73±7.35	113.53±6.38	0.014
90	77.87±5.32	74.21±8.33	0.048	74.80±6.11	68.07±7.38	0.012	118.67±7.79	113.14±6.44	0.048

SD: standard deviation, P value <0.05: significant

Table 9 shows intraoperative mean heart rate, mean systolic and diastolic BP with standard deviation at various time points during the surgery. Significant difference in heart rate, SBP and DBP was found from 20 minutes following the administration of block for the remainder of the surgery. (p<0.05)

Table 10: Intraoperative degree of sedation among the groups

Ramsay sedation score	Degree of sedation	Group R+F	Group R+D
1	Awake and alert	24	20
2	Drowsy but responsive to command	16	16
3	Very drowsy but responsive to pain	0	4
4	Unresponsive		

Table 10 shows the degree of sedation in both groups.In group R+F- 24 patients out of 40 patients were awake and alert and 16 patients weredrowsy.In group R+D - 20 patients out of 40 patients were awake and alert and 16 patients were drowsy, four patients achieved grade 3 sedation in group R+D

Table 11:Comparison of VAS Score among study groups

		R +D		R+F		Grand Total	
		No	%	No	%	No	%
0 min	0	40	100	40	100	80	NA
30 min	0	40	100	40	100	80	NA
1 hr	0	25	62.5	25	62.5	50	0.82
	1	15	37.5	15	37.5	30	
3 hr	1	28	70	20	50	48	0.110
	2	12	30	20	50	32	
6 hr	3	20	50	11	27.5	31	.042
	4	12	30	23	57.5	35	
	5	8	20	6	15	14	
12 hr	4	36	90	30	75	66	0.314
	5	3	7.5	5	12.5	8	
	6	1	2.5	5	12.5	6	
18 hr	2	22	55	20	50	42	1.0
	3	10	25	8	20	18	
	4	4	10	7	17.5	11	
	5	4	10	5	12.5	9	

P value <0.05: significant

Table 11 depicts the distribution of cases according to comparison of VAS Score among study groups. There was significant difference observed between the two groups at 6 hrs. Cases with Post operative VAS ≥4 was observed more in R+F group as compared to Group R+D group at 6 hrs. (72.5% vs 50%).

This signifies that in R+D have prolonged duration of analgesia as compared group R+F.

Table 12:Comparison of side effects between study groups

	R +D(N=40)		R+F(N=40)		Grand Total		P Value
Side Effects (if any)	No	%	No		No	%	
Hypotension	0	0	2	0.48	2	22	0.48
Bradycardia	1	2.5	0	1.0	1	11	1.0
Nausea	3	7.5	2	1.0	5	55	1.0
Vomiting	1	2.5	0	1.0	1	11	1.0
And any other	0	0	0	NA	0	0	NA

In the present study, 2 cases developed hypotension in R+F group which was treated by injMephentermin 6mg and bradycardia was observed in only single case in R+D group which was treated by inj Atropine 0.6 m.(Table12).

Discussion

Analgesia is an essential component of intraoperative and post operative period. Fear of pain increases anxiety and stress response resulting in increased level of corticosteroids and susceptibility to postoperative infection.In the present study brachial plexus block was given by classical supraclavicular approach by eliciting paresthesia and satisfactory surgical anaesthesia was attained in all the cases for various types of upper limb surgeries.The present work was carried out as a prospective, randomised, double blind studyto evaluate and compare the effect of Dexmedetomidine& Fentanyl as adjutants to ropivacaine, in terms of onset time, degree and duration of sensory and motor blockade, duration of analgesia and various side effects ie. Hypotension, bradycardia, nausea, vomiting, respiratory depression and sedation under supraclavicular brachial plexus block in upper limb surgeries. Both groups were evenly matched with respect to age, weight, sex and ASA grading(Table 2).

Sensory block

- **Onset of sensory bock**: The results of our study showed the onset of sensory block for group R+F was at 7.2+ 5.4 mins and for group R+D was at 6+1.8 mins. The onset of sensory block was found to be statistically insignificant between the groups (p value 0.12). (Table 3)
- **Grade of sensory block**: There was no statistically significant difference in grade of sensory block in both the groups. In group R+D 95 % of patients achieved grade 2 block while in R+F group 92.5% patients achieved grade 2 sensory block. It shows quality of block was excellent in both the groups. (Table 4)
- **Duration of sensory block** : In our study we found the mean duration of sensory block was less in group R+F (210±40.2min) as compared to group R +D (235.8±57mins) which was statistically significant (P=0.02S) (Table 6).

Dharmarao PS et al[17] studied the efficacy of dexmedetomidine and fentanyl as adjuvant to ropivacaine in ultrasound guided supraclavicular block. They concluded that there was no statistically significant difference observed in terms of onset of sensory and motor block between two groups but dexmedetomidine prolongs duration of sensory and motor block and postoperative analgesia.Pradeep Sahi et al[18] observed that the addition of fentanyl or dexmedetomidineto ropivacaine 0.5%, enhanced onset of sensory block as compared to ropivacaine used alone. Onset of sensory block was earlier in fentanyl group but result was statistically insignificant. Duration of sensory block wassignificantly longer in dexmedet-omidne group. Nyla Farooq et al[12]concluded that onset of sensory and motor block was earlier in fentanyl group as compared to dexmedetomidine group when used as adjuvants with ropivacaine in supraclavicular block.Duration of sensory block was more in fentanyl group as compared to dexmedetomidine group.Soma C Cham et al[19] concluded that addition of 50 mcg fentanyl or 50 mcg of dexmedetomidine to ropivacaine enhanced onset of sensory and motor block. In fentanyl group onset was earlier as compared to dexmedetomidine group. Duration of sensory block was more in dexmedetomidine group. Quality of block was excellent in both the groups.The study done by Ammar AS et al[20] and Kaygusuz K et

al[21] found an earlier onset in sensory block only with no difference in onset of motor block.

Motor Block

Onset of motor block- In our study we found that onset of motor block was at 14.64±10.26 mins in R+F group and at 14.22±8.94 mins in R+D group. The results were statistically insignificant for both the groups (p=0.86). (Table 3)

Degree of motor block - In our study 87.5% patients achieved grade 3 motor block in R+F group while in R+D group 92.5% patients achieved grade 3 motor block. Overall 90% of patients falls under 3 grade of motor block and 10% for 2 grade of motor block. (Table 5)

Duration of motor block -We found duration of motor block for R +F group was 232.2±57 min and for group R +D was 279+63.6 mins. There wassignificant prolongation of duration of motor block with dexmedetomidine group as compared to fentanyl group when used as adjuvants to ropivacaine .5%. (P value 0.001). (Table 6)

Our study findings are supported byDharmarao et al[17]found no statistically significant difference in terms of onset of motor block in dexmedetoidine and fentanyl groups when used as adjuvants to ropivacaine. Duration of motor block was prolonged in dexmedetomidine group (649.5±42.73) in comparison to fentanyl. (456.75±32.93) (P Value <0.0001).Marhofer et al[22] added dexmedetomidine as adjuvant to ropivacaineand showed that the time for the onset of motor block is decreased without effect on time to the onset of sensory block. The duration of both sensory and motor block was prolonged.Soma C Cham et al[19] found onset of motor block was earlier in R+D group (3.26±45) then R+F group (3.06±0.25) but results were statistically insignificant.(P>.05). They found duration of sensory and motor block was also prolonged in dexmedetomidine group.Das et al[23]found that onset of motor block was earlier in R+D group (P<0.05)as compared to R group. Duration of motor block was also enhanced in R+D group (P<0.05).In contrast to our study Nyla Farooq et al[12]found onset of motor block was earlier in fentanyl group in comparison of dexmedetomidine group. Duration of motor block was also longer in fentanyl group. Whereas Ammar AS et al[20] and Kaygusuz K et al[21] found no difference in onset of motor block when dexmedetomidine was used as adjuvant to bupivacaine in brachial plexus block. The action of dexmedetomidine on the α2 receptors in the locus coerulus and dorsalhorn of spinal cord reduces central sympatholytic output, resulting in increased firing of inhibitory neurons and hence producing analgesia is a known feature. Peripheral α2 receptors may also provide anti-nociception. Reduction of calcium conductance into cells, thus inhibiting neurotransmitter release is other prominent physiologic action ascribed to α2 adrenoceptors.The activation of inwardly rectifying G1 protein-gated potassium channels, resulting in membrane hyperpolarisationand decrease in the excitability of the CNS cells and the reduction of calcium conductance into the cells, inhibiting neurotransmitter release, are the probable mechanisms of action of dexmedetomidine[18]

The anaesthetic and analgesic effect as observed in Group R+F could be attributed to fentanyl directly acting on the peripheral nervous system. The existence of endogenous and exogenous opioid receptors in the peripheral nervous system and the initiation of anti-nociceptive action by the activation of such receptors offer the possibility of extended analgesic action and in the substantia gelatinosa after its centripetal axonal transport after perineural injection[12]

Duration of analgesia(minutes) and VAS-In our study we observed that the mean duration of analgesia was higher in group R+D (356.13±19.66min) as compared to group R+F (301.75±14.87mins) (P<0.001). (Table 7)Our results were similar with study done by Dharmarao PS et al[17]. They also concluded that dexmedetomidine prolongs the duration of post operative analgesia as compared to fentanyl when used as an adjuvant to ropivacaine in supraclavicular block.Swastika Swaro et al found that the duration of analgesia (time to requirement of rescue analgesia) in group B+D was 471.44+-65.88 min and in group B+F it was 366.48+-38.02 (P <0.0001)[24]But Nyla Farooq et al[12] concluded that duration of analgesia or R+F group was 7.54±0.51 hrs and for group R+D was 5.43±0.78 hrs.Duration of analgesia was significantly prolonged in fentanyl group.(P value <0.001).In our study,there was significant difference observed between the two groups at 6 hrs in terms of VAS.Cases with post operative VAS ≥4 was observed more in F group as compared to Group D at6 hrs. (72.5% vs 50%). This signifies that in R+D have prolonged duration of analgesia as compared group R+F. (Table 11)

Effect on vital parameters:

Heart rate: The mean baseline heart rate was 73.20±6.55 beats/minute in the R+F group and 74.65±4.44 beats/minute in the R+D group. It was comparable in both the groups. A fall in heart rate was seen in both the groups following the administration of block; however, a greater decrease in heart rate occurred in the dexmedetomidine group as compared to the fentanyl group. Statistically significant decrease in heart rate was seen 20 minutes following the administration of block but no active clinical intervention was required. (Table 8, 9)Similar findings were seen in studies done by Soma c cham et al[19].This could be explained by the fact that α_2 agonists enhance baroreceptor sensitivity and presynaptically mediated inhibition of norepinephrine release at the neuroeffector junction or by the vagomimmetic effect. Dexmedetomidine having a greater selectivity towards α_2 receptors, produced a greater fall in heart rate when compared to fentanyl.

Blood pressure: Themean baseline systolic blood pressure in group R+D was 124.10+9.62mm hg and in group R+F was 125.70+9.04 mm hg. The mean diastolic blood pressure in group R+D was 77.73+6.81 mm hg and in group R+F was 77.70+5.46 mm hgwhich was comparable in both the groups. Statistically significant change was observed after 20 minutes of administration of block till 1 hour post operatively, with both the groups showing a fall in the above variables duringthe above specified time. There was a greater fall seen with dexmedetomidine.However, fall in blood pressure was easily managed by intravenous fluid and no drug therapy was required. (Table 8, 9)Similar findings were seen in studies done by soma c cham et al[19]. Dexmedetomidine act by stimulating α_2 receptors in the vasomotor centre in the brainstem, which decreases peripheral vascular resistance, thereby lowering blood pressure. This binding of the drugs to the receptors decreases the presynaptic calcium levels, thus inhibiting the release of norepinephrine. The net effect is a decrease in the sympathetic tone, resulting in a decrease in blood pressure. Dexmedetomidine has a higher specificity towards the presynaptic α_2 receptors, thus produces a greater fall in blood pressure.The patients in both the groups had an uneventful course without any major complications. Respiratory rate (per min)/ oxygen saturation: There was no significant difference observed between these groups either intraoperatively or postoperatively.This was in line with study done by Dharmarao et al[17] who found that dexmedetomidine and fentanyl does not cause any change in respiratory rate.

Ramsay Sedation score (RSS): In our study we found statistically significant difference in level of sedation at 30 mins postoperatively among study groups. (P value 0.006). in R+D 16 patient out of 40 achieved grade 2 sedation and gade 3 sedation was seen in 19 patients out of 40 patients. In R+F group 30 Patients had grade 2 sedation out of 40 patients and 7 patients had grade 3 sedation out of 40 pattients. Statistical analysis shows group R+D had higher RSS as compare to R+F group. (Table 10)This was in line with study done by Swastika Swaro et al [24]on total 50 patients.They observed Sedation score of 3 was more in group B+D. S Mathew et al[25] also fount that the sedation Score were significantly higher in group Ropivacaine + dexmedetomidine (median -3) and ingroup Ropivacaine +Midazolam (Median -2). Both dexmedetomidine and midazolam when added to ropivacaine produce significant sedation.

Complications

In the present study no significant side effects were observed in both the groups. Two cases developed hypotension in R+F group which was treated by injMephentermin 6mg andbradycardia was observed only in one case of R+D group which was treated by inj Atropine 0.6 mg. 4 patients in R+D group had nausea and vomiting while 2 patients in group R+F had vomiting.No any other side effects were observed in both the groups. (Table 12)None of the patients in both the groups required sedation intra-operatively and they were comfortable throughout the surgery with arousable sedative effects.

Limitations

1. The major limitations of our study was that we did not use ultrasound and peripheral nerve stimulator for supraclavicular blocks because of unavailability at the time of our study, this could have helped us to lower dosages and volumes of local anaesthetic.
2. The limitation of our study was that we did not biochemically analyze the blood concentration of Ropivacaine, Fentanyl and Dexmedetomidine.
3. The population enrolled was in the age group of 18-60 years which were otherwise healthy patients of ASA Grade I and II, so the effect of Dexmedetomidine as an adjuvant in older patients with cardiovascular co morbidities is yet to be investigated.

Conclusion

The present study concluded that

- The upper limb surgeries performed under the influence of supraclavicular block with .5% ropivacaine anddexmedetomidine 1 μg/kg as an adjuvant is highly effective in prolonging the duration of sensory and motor blockade and duration of analgesia with better quality of block as compared to 0.5% ropivacaine with fentanyl (1μ/kg).
- So the patient remains comfortable in post opeative period with considerable therapeutic benefits.
- Overall, both the drugs did not produce any significant side effect to be recorded as an event and can be termed as safe profile of the drugs.

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