Original Research Article

Comparative study for anaesthetic quality with the addition of clonidine, fentanyl or dexmedetomidine to 0.5% ropivacaine in supraclavicular brachial plexus block at a tertiary hospital

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Abstract

Background: Supraclavicular Brachial plexus block also described as the "spinal of arm", provides a rapid onset, complete, predictable and dense anaesthesia for mid humerus, forearm and hand surgery. Brachial plexus block also cause sympathetic block with resultant improvement in blood flow, reduction in vasospasm and edema which is more favorable for acute hand injury and reconstructive plastic surgery. In present study we compared the anaesthetic quality with the addition of either clonidine, fentanyl or dexmedetomidine to 0.5% ropivacaine for supraclavicular brachial plexus block in regard to the onset and duration of sensory/motor block and duration of analgesia at a tertiary hospital. **Material and Methods:** Present study was prospective, interventional and comparative study carried out in the department of anaesthesiology, in patients 18-60 years, ASA grade1/2, Mallampati grades 1 and 2, posted for elective upper limb surgeries. 60 patients were randomly divided into three groups, each group includes 20 patients, (Group D- Dexmedetomidine, C- Clonidine, F- Fentanyl). **Results:** 60 patients scheduled to undergo elective upper limb surgeries were randomly divided into three groups (Group D, C, F), each group includes 20 patients. Age, gender, ASA status, weight, height and mean duration of surgery were comparable in three groups and difference was statistically insignificant. Difference between onset of sensory blockade, mean time of onset of complete sensory blockade, duration of complete sensory blockade was found to be statistically significant. **Conclusion:** Dexmedetomidine, clonidine added to ropivacaine shortens the onset of sensory and motor blockade, prolongs the duration of sensory blockade as compared to fentanyl. Dexmedetomidine shortens onset of sensory and motor blockade much more than clonidine.

Key Words: Dexmedetomidine, clonidine, fentanyl, supraclavicular brachial plexus block.

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INTRODUCTION

Supraclavicular Brachial plexus block also described as the "spinal of arm", provides a rapid onset, complete, predictable and dense anaesthesia for mid humerus, forearm and hand surgery. Brachial plexus block also cause sympathetic block with resultant improvement in blood flow, reduction in vasospasm and edema which is more favorable for acute hand injury and reconstructive plastic surgery.[1] Ropivacaine is an amino amide local anesthetic have lesser lipid solubility and also produce less central nervous toxicity and cardio toxicity with less

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arrhythmogenic potential. The purpose of adding an adjuvant to local anesthetics for peripheral nerve block is to have an early onset of sensory and motor block and to prolong the duration of post-operative analgesia with lesser adverse effects.[2]Clonidine is an α 2-agonist usually prolongs the duration of postoperative analgesia and have sedative, sympatholytic and analgesic property. Dexmedetomidine, an α2-receptor agonist, with α2/α1 selectivity, reported to improve the onset and duration of analgesia when given as adjuvant to local anaesthetics.[3] Fentanyl is an opioid pain medication, a potent agonist of μ receptors, rapid onset and short duration of action with side effects of nausea, vomiting, pruritus and respiratory depression has its own limitations. Present study was aimed to compare the anaesthetic quality with the addition of either clonidine, fentanyl or dexmedetomidine to 0.5% ropivacaine for supraclavicular brachial plexus block in regard to the onset and duration of sensory/motor block and duration of analgesia at a tertiary hospital.

MATERIAL AND METHODS

Present study was prospective, interventional and comparative study carried out in the department of anaesthesiology, Gandhi medical college and associated hospitals (Hamidia and Sultania), Bhopal from January 2018 to July 2019 (1 year). Approval for present study was taken from the Institutional Ethics Committee

Inclusion criteria

- Age 18-60 years, ASA grade1/2, Mallampati grades 1 and 2, posted for elective upper limb surgeries.

Exclusion criteria

- Age <18yrs and >60yrs.
- ASA grades 3 and more
- History of serious pulmonary, coronary artery, or cervical spine disease and patients with bleeding diasthesis with abnormal coagulation profile
- Patient with h/o drug abuse with local skin site infections were excluded
- Patients with pheochromocytoma, patients on b blocker, antidepressants, anticonvulsants, antipsychotics were also excluded.

An informed written consent was taken from all the patients after explaining every patient in detail regarding nature and purpose of the study and also for the possible risks and complications. 60 patients were randomly divided into three groups, each group includes 20 patients, they were scheduled to undergo elective upper limb surgeries.

1. Group D (n=20) - Inj Dexmedetomidine 50 mcg plus 29ml 0.5%ropivacaine
2. Group C (n=20) - Inj Clonidine 50 mcg plus 29 ml 0.5%ropivacaine
3. Group F (n=20) - Inj Fentanyl 50 mcg plus29 ml 0.5%ropivacaine

All the patients were subjected to detailed pre-anaesthetic evaluation with clinical history, thorough physical and systemic examination, routine investigation which include complete blood count, urine (routine and microscopy), blood sugar, renal function test, serum electrolytes, X-ray chest PA view, ECG and any special investigation ,if required was done for the study. In the operation theatre patients were kept in supine position, an I.V. cannula (18G) was inserted. Before starting the procedure all the monitoring equipments (like NIBP Cuff, Pulse Oxymetry finger probe, ECG) were attached to the patient and baseline values of Heart rate, BP, SpO2 and Respiratory rate were recorded. Patients were put in supine position with head turned to non-operated side and arm pulled down gently. To make the field more prominent ,a folded sheet was kept behind the shoulder. Under all aseptic precautions, an intradermal wheal with 1ml 2% lignocaine plain at the selected point (point 1cm above the clavicle at junction of inner 2/3rd and outer 1/3rd of clavicle) was raised . A needle of 22G inserted through the wheal directed medially and inward at the angle of 20 degree to the skin until the paresthesia elicited in the hand .After this the calculated drug was injected after negative aspiration test to avoid intravascular injection.

Sensory block in the surgical procedure planned site was tested by using the pinprick test and compared with the same stimulation in the contralateral hand:

1. Normal sensitivity—0 (no block)
2. Reduced sensitivity compared with the same territory in the contralateral upper limb—1 (onset)
3. Analgesia or loss of the sharp sensation of the pinprick—2 (partial)
4. Anaesthesia or loss of sensation to touch—3 (complete)

Motor blockade was assessed by a 3 point motor scale described by Bromage:

1. 0 - Full flexion and full extension of elbow , wrist and fingers.
2. Almost complete block: Inability to flex the arm and decreased ability to flex the forearm, Ability to move fingers.
3. Total block: inability to flex both arm and forearm, Inability to move fingers.

Duration of analgesia was the time from injection of the drug for brachial block until the patients complaining of pain or when VAS score was 3. Postoperative analgesia was assessed by the 10 point visual analogue scale. And required additional analgesia or 1st rescue analgesia in postoperative period which was assessed by visual analogue score of ≥5. Rescue analgesic used was Inj. Diclofenac Sodium 75 mg intravenously and time for first

rescue analgesic given was also noted down. The data obtained was subjected to statistical analysis using computer software (SPSS version 20; Chicago Inc., USA). The qualitative data were expressed in proportion and percentages and the quantitative data expressed as mean and standard deviations. The difference in proportion was analyzed by one way ANOVA test and the inter group difference in means were analyzed by using post – hoc Tukey test. Significance level for tests was determined as 95% (P< 0.05).

RESULTS

60 patients scheduled to undergo elective upper limb surgeries were randomly divided into three groups (Group D, C, F), each group includes 20 patients. Mean age in years, mean weight in kgs, mean height in cm and mean duration of surgery were comparable in three groups and difference was statistically insignificant.

Table 1: Demographic profile of patients

PARAMETER	GROUP D		GROUP C		GROUP F		p value
	MEAN	±SD	MEAN	±SD	MEAN	±SD	
AGE(18-50 Yrs)	39.25	11.16	36.8	10.34	36.85	9.07	0.85
Height (in cm)	159.86	3.78	159.56	3.63	160.66	3.79	0.50
Weight (in Kg)	57.27	9.34	57.10	8.99	55.23	7.90	0.61
Duration of surgery (mins.)	164.25	13.13	162.75	14.74	159.1	13.13	0.456

61.66% male and 38.33% female and 46.66% of ASA GRADE I and 53.33% of ASA GRADEII patients were included in this study. Randomly selected groups were similar in terms of sex and ASA grade as their difference is statistically insignificant and therefore are comparable for this study.

Table 2: Distribution according to ASA GRADE I and II

PARAMETER	Group D	Group C	Group F	P VALUE
ASA GRADE I	9	8	11	0.870
II	11	12	9	

Mean time of onset of sensory blockade seen in three different groups were in Group D 6.6 ± 0.568 mins, in Group C 8.5 ± 0.512 mins and in Group F 8.8 ± 0.69 mins. Mean time of onset of complete sensory blockade seen in different groups were in Group D 8.3 ± 0.470 mins, in Group C 10.25 ± 0.550 mins and in Group F 10.95±0.79 mins. Mean time of duration of sensory blockade seen in different groups were in Group D 708.33 ± 14.99 mins, Group C 609.1 ±18.99 mins and in Group F 592.45±13.12 mins. Difference between onset of sensory blockade, mean time of onset of complete sensory blockade, duration of complete sensory blockade was found to be statistically significant (p<0.05). Inter group analysis in group D, C and F for onset of sensory blockade, onset of complete sensory blockade and duration of complete sensory blockade in three different groups noted a statistically significant difference.

Table 3: Comparision of onset and duration of sensory blockade (min.) in three different groups

Parameters	Group D		Group C		Group F		P VALUE
	Mean	±SD	Mean	±SD	Mean	±SD	
Onset of sensory blockade (min.)	6.6	0.68055	8.5	0.51298	8.8	0.6959	< .00001
Complete sensory Blockade onset (min.)	8.3	0.47	10.25	0.55	10.95	0.795	<0.00001
Duration of sensory blockade (min.)	708	14.99	609.1	18.99	592.45	13.12	< .00001

Mean time of onset of motor blockade seen in different groups were in Group D 9.15 ± 0.58mins , in Group C 11.35 ±0.67 mins and in Group F 11.85±0.74 mins. Mean time of complete motor blockade seen in different groups were in Group D 11.05 ± 0.51mins , in Group C 13.45 ±0.60 mins and in Group F 14.1±0.85 mins. Mean time of duration of motor blockade seen in different groups were in Group D 674 ± 14.30 mins , in Group C 545 ±21.80 mins and in Group F 533.85±13.68 mins. Difference for onset of motor blockade, onset of complete motor blockade and duration of motor blockade was found to be statistically significant as (p<0.05) , there is difference noted between Group D, C and F. Intergroup statistical analysis of onset of motor blockade, onset of complete motor blockade and duration of motor blockade between group D vs C and group D vs F were statistically significant p (< 0.05), whereas between group C vs F it was insignificant (p > 0.05).

Table 4 : Comparison of onset and duration of motor blockade (min.) in three different groups

Parameters	Group D		Group C		Group F		P VALUE
	Mean	±SD	Mean	±SD	Mean	±SD	
Onset of motor blockade(min.)	9.15	0.587	11.35	0.67	11.85	0.745	< .00001

Complete motor Blockade (min.)	11.05	0.510	13.45	0.604	14.1	0.852	<0.00001
Duration of motor blockade (min.)	674	14.301	545.4	21.803	533.85	13.681	< .00001

Duration of analgesia in Group D was 832.75 ± 18.96 mins, in Group C was 756.6 ±18.94 mins and in Group F was 722.9± 18.18 mins. The duration of analgesia was prolonged in Group D,C,F. These changes were found to be statistically significant ($p<0.05$). Intergroup analysis of duration of analgesia between three different groups. Difference between group D vs C, between group D vs F and between group C vs F were statistically significant ($p < 0.05$).

Table 5: Duration of analgesia (min) in three different groups

Parameters	Group D		Group C		Group F		P VALUE
	Mean	±SD	Mean	±SD	Mean	±SD	
Duration of analgesia (min.)	832.75	18.96	756.6	18.94	722.9	18.18	<0.00001

Time of 1st rescue analgesia in Group D was 845.7 ± 15.32 mins, in Group C was 785.4 ±13.45 mins and in Group F was 746.1± 13.15 mins. The time of 1st rescue analgesia was prolonged in Group D,C,F. These changes were found to be statistically significant ($p<0.05$). Intergroup analysis of time of 1st rescue analgesia between three different groups. Difference between group D vs C, between group D vs F and between group C vs F were statistically significant ($p < 0.05$).

Table 6: Time of 1st rescue analgesia (min) in three different groups

PARAMETER	Group D		Group C		Group F		P VALUE
	Mean	±SD	Mean	±SD	Mean	±SD	
Time of 1st rescue analgesia (min.)	845.7	15.32	785.4	13.45	746.1	13.15	<0.00001

We analysed pulse rate, systolic and diastolic blood pressure in three groups. Changes in pulse rate in Group D, C and F were remaining statistically insignificant ($p>0.05$) upto 20 mins after brachial block but there after differences were become statistically significant($p<0.05$). On inter group analysis of changes in pulse rate in three groups, differences in changes in pulse rate between group D vs C and between group D vs F were remaining insignificant up to 20 mins after Brachial block but it was significant afterward ($P <0.05$). In group D, PR goes on decreasing or change is significant ($p <0.05$) whereas in group C and F changes in pulse rate were remaining insignificant as ($p>0.05$). Changes in systolic blood pressure changes in three different groups. There was significant fall in the systolic blood pressure in Group D as compare to group C and F ($p<0.01$) after 20 minutes of brachial block. On statistical analysis these changes were significant in Group D. ie p(<0.05). On intergroup analysis changes in SBP between Group D and C and Group D and F were statistically significant. ($p<0.05$), whereas between Group C and F were statistically insignificant ($p>0.05$). There was significant fall in the diastolic blood pressure in Group D as compare to group C and F ($p<0.05$) after 20 minutes of brachial block. On statistical analysis these changes were statistically significant. And in Group C and F changes in mean Diastolic Blood Pressure were insignificant from basal value till the end of surgery. On statistical analysis these changes were statistically insignificant in both the Groups. On intergroup analysis changes in DBP between Group DandC and Group D and F were statistically significant($p<0.05$), whereas between Group C and F were statistically insignificant ($p>0.05$). In Group D , the Mean ± SD VAS score was remaining insignificant up to 8 hrs, thereafter VAS score significantly increased and remain on higher side throughout study and in Group C, F the mean VAS score was 0 up to 6-7 hrs respectively thereafter the VAS score increased significantly, thus the time to give rescue analgesia in Group D was significantly higher than other two groups.

Table 7: Statistical analysis of vas score (Mean ± SD) between three groups

VAS SCORE	Group D		Group C		Group F	
	Mean	±SD	Mean	±SD	Mean	±SD
1hr	0.000	0.00	0.000	0.00	0.000	0.00
2hrs	0.000	0.00	0.000	0.00	0.000	0.00
3hrs	0.000	0.00	0.000	0.00	0.000	0.00
4hrs	0.000	0.00	0.000	0.00	0.000	0.00
5hrs	0.000	0.00	0.000	0.00	0.000	0.00
6hrs	0.000	0.00	0.000	0.00	0.000	0.00
7hrs	0.000	0.00	0.000	0.00	0.50	0.512
8hrs	0.000	0.00	0.50	0.512	1.40	0.68
9hrs	0.50	0.51	1.40	0.68	2.40	0.68
10hrs	1.40	0.68	2.40	0.68	3.40	0.68
11hrs	2.40	0.68	3.40	0.68	4.40	0.68

12hrs	3.40	0.68	4.40	0.68	5.35	0.67
13hrs	4.40	0.68	5.35	0.67	6.35	0.67
14hrs	5.40	0.68	6.35	0.67	7.35	0.67

Nausea in Group D was 10% while in Group C had 15% and in Group F had 15% and vomiting was 10% in Group F and 25% in patients in Group F had pruritus too. Incidence of side effects was more in Group F compared Group D and Group C.

Table 8: Side effects in all three groups

Complications	Group D		Group C		Group F	
	N	%	N	%	N	%
Nausea	2	10	3	15	3	15
Vomiting	0	0	0	0	2	10%
Pruritus	0	0	0	0	5	25%

DISCUSSION

Brachial plexus blockade provide an excellent alternative technique to general anaesthesia for upper limb surgical procedures. It not only offers excellent intraoperative pain relief but also good post-operative analgesia. Supraclavicular technique provides a rapid onset, dense and predictable anaesthesia with high success rate. Supraclavicular approach is one of the easiest and most consistent method for performing brachial plexus block. Successful brachial plexus block depends on proper nerve localization, needle placement, local anesthetic injection i.e. right drug, right dose, placed in the right place, by the right technique. In present study with addition of clonidine, fentanyl or dexmedetomidine to 0.5% ropivacaine in supraclavicular brachial plexus block, difference between onset of sensory blockade, mean time of onset of complete sensory blockade, duration of complete sensory blockade was found to be statistically significant ($p<0.05$). Dexmedetomidine, clonidine added to ropivacaine shortens the onset of sensory and motor blockade as compared to fentanyl. Similar results were noted in other studies.[4,5,6,7] Harshavardhana H S,[4] conducted a prospective, randomized, double blind study on efficacy of dexmedetomidine compared to clonidine added to ropivacaine in supraclavicular nerve block, concluded that dexmedetomidine prolongs the duration of sensory block compared to clonidine when added to ropivacaine in supraclavicular nerve block. Cham and Sangawar,[5] compared effects of fentanyl and dexmedetomidine in supraclavicular brachial plexus block acheived with ropivacaine, concluded that dexmedetomidine when added to ropivacaine 0.5% prolongs the duration of sensory block having 511±30.45 mins as compared with fentanyl having 458±20.62 mins without any significant side effect. Don Sebastian and Ravi M,[6] studied dexmedetomidine and clonidine as adjuvant to ropivacaine in supraclavicular brachial plexus nerve blocks, conclude that dexmedetomidine when added to ropivacaine in supraclavicular brachial plexus block has faster onset of sensory blockade and prolonged duration of sensory blockade. Similarly Suneet Kathuria,[7] concluded that addition of dexmedetomidine (50 µg) to 30 ml ropivacaine 0.5% in ultrasound-guided supraclavicular brachial plexus block resulted in a quick onset of sensory block and prolonged duration of sensory block as compared to ropivacaine group alone. While Nyla Farooq[8] concluded that fentanyl 1mcg/kg when added to 0.75% ropivacaine was most efficacious than dexem 1mcg/kg when added to 0.75% ropivacaine in onset of sensory block and duration of sensory blockade. In present study we noted that dexmedetomidine, clonidine when added to ropivacaine prolongs the duration of sensory blockade as compared to fentanyl, where in dexmedetomidine prolongs much more than clonidine. Dexmedetomidine when added to ropivacaine prolongs the duration of motor blockade as compared to clonidine and fentanyl. Similar results were noted in other studies.[9,10,11] Vania Kanvee, Kena Patel[9] concluded that the efficacy of dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block for upper limb surgery was superior to clonidine because longer duration of motor blockade than Clonidine without significant adverse effects. Vallem Balasubramanyam,[10] concluded that that dexmedetomidine 1 mcg/kg as an adjuvant result early onset of motor blockade, prolonged duration of motor blockade and with better quality of block as compared to clonidine 1 mcg/kg when added to ropivacaine in supraclavicular brachial plexus block. Dharmarao P and Holyachi R,[11] noted that Dexmedetomidine prolongs the duration of motor block as compared to fentanyl but the onset of motor blockade was not statistically significant among the two study groups. While Nyla Farooq,[8] noted that fentanyl 1mcg/kg when added to 0.75% ropivacaine was most efficacious than dexem 1mcg/kg when added to 0.75% ropivacaine in onset of motor block having 20 mins for fentanyl group and 30 min in dexem group. Duration of analgesia achieved in our study was more in Dexmedetomidine group as compared to Clonidine and Fentanyl group. Similarly dexmedetomidine is more efficacious than Clonidine and Fentanyl in providing postop analgesia and requirement of rescue analgesia is delayed by dexmedetomidine. Similar results were noted

in other studies.[4,5] Dexmedetomidine has anxiolytic, sedative, analgesic, antisialogogue and sympatholytic properties which render it suitable as a premedication agent. The ongoing sedation and sympatholytic effects is beneficial in reducing postoperative myocardial ischemic events in high risk patients undergoing non-cardiac surgery. Dexmedetomidine causes significant prolongation of sensory and motor blockade when used in regional anaesthesia. Addition of 0.5µg/kg body weight of dexmedetomidine to lidocaine for intravenous regional anaesthesia improves the quality of anaesthesia and perioperative analgesia.

CONCLUSION

We compared anaesthetic quality with 0.5% ropivacaine in supraclavicular brachial plexus block with the addition of clonidine, fentanyl or dexmedetomidine. Dexmedetomidine, clonidine added to ropivacaine shortens the onset of sensory and motor blockade, prolongs the duration of sensory blockade as compared to fentanyl. And dexmedetomidine shortens onset of sensory and motor blockade much more than clonidine. Duration of analgesia, time for first rescue analgesia was more prolonged when dexmedetomidine, clonidine were added to ropivacaine as compared to fentanyl wherein dexmedetomidine prolonged much more than clonidine.

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