

COMPARISON OF EFFICACY OF ADDING DEXMETEDOMINE VERSUS FENTANYL TO BUPIVACAINE IN USG GUIDED BRACHIAL PLEXUS BLOCK.

Anaesthesiology

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ABSTRACT

This study was carried out by adding Dexmedetomidine and Fentanyl to Bupivacaine in Ultra Sonographic (USG) guided brachial plexus block, to study the comparative efficacy in terms of onset, duration, postoperative analgesia and sedation and to study the adverse effect of Bupivacaine with Dexmedetomidine and Fentanyl. This randomized, controlled, single blind, observational study was done on 60 patient of age group 18-65 yrs of either sex & ASA physical status I and II posted for routine upper limb surgery, divided into two groups (n=30) assigned to receive USG guided brachial plexus block with 35ml Bupivacaine 0.375% and Dexmedetomidine 50µg. Group BD and other Group BF received 35 ml Bupivacaine and Fentanyl 75 µg. There was significant early onset of sensory (6.033±1.12) min and motor (7.93±1.55) min block in Group BF. Duration of motor block in Group BD was (10.53±1.35) hrs and in Group BF was (6.96±0.99) hrs and sensory duration in Group BD was (12.24±1.30) hrs and in Group BF was (7.96±1.03) hrs, which was significant (P < 0.0001). Postoperative mean VAS at 6-24 hrs (2.26±0.78) was significantly lower in Group BD and after that no difference noted. Group BF has significantly more sedation score (2.43±0.50) than Group BD (1.96±0.49) at 0-6 hrs. No side effects were noted. Fentanyl versus Dexmedetomidine added to Bupivacaine improves the quality of block without any major side effect but Dexmedetomidine is better in terms of duration of both motor and sensory blocks and postoperative analgesia.

KEYWORDS

Bupivacaine, Fentanyl, Dexmedetomidine, Brachial plexus block.

INTRODUCTION

Regional anesthesia provides site specific, effective and long lasting anesthesia. Brachial plexus is good option for upper limb surgery. It avoids the side effects of general anesthetic drugs and intubation. It achieves complete muscles relaxation, intraoperative hemodynamics stability and postoperative analgesia.¹ Regional analgesia technique reduce neuroendocrine stress response, thromboembolic phenomenon and requirement of intravenous analgesia in the postoperative period.²

use of adjuvant improves the efficacy of local anesthetic by decreasing the onset of action, prolonging the duration of action and post-operative analgesia. Opioids as additives extend post-operative pain relief along with improving the quality of analgesia but they result in urinary retention, sedation and pruritus.³ Dexmedetomidine is also alpha 2 adrenoreceptor agonist and its selectivity to alpha 2 adrenoreceptor is 8 times greater than clonidine.⁴ The anesthetic and analgesic requirements get reduced to a huge extent by the use of these adjuvants because of their analgesic properties and augmentation of local anesthetic effects.

There are multiple approaches to produce a brachial plexus block. Traditional approaches have varying success rate. It is therefore not surprising that ultrasound guided techniques have become so popular because they improve the success rate, simplify the technique and decrease turnaround time, reducing complications.

In a prospective single blind randomized study, this is our attempt to assess comparison of efficacy of adding Dexmedetomidine and Fentanyl to Bupivacaine in ultrasonography guided brachial plexus block for patient undergoing upper limb surgeries.

MATERIALS AND METHOD

After obtaining institutional ethical approval from Institutional ethics committee, B.J Medical college & civil hospital, Ahmedabad (Ref NO. IEC/certi/31/17). 60 patients who presented for routine upper limb surgery in orthopedic department were checked for eligibility to participate in the study. All patients aged 18-65 yrs belonging to American Society of Anesthesiologist (ASA) physical status I, II were selected. While patient who refused, or had some history of cardiac, respiratory, renal, hepatic failure, coagulation disorder, local

site infection, psychological disorder, allergic to study medication, or patient with h/o substance abuse and current opioid use were not selected for the study. Patient were divided into two groups, Group BD and Group BF, randomly by computer generated random number sequence for the study. Odd numbers were selected for group BF and even numbers were selected for group BD. Group BD (n = 30) received brachial plexus block with 35ml 0.375% Bupivacaine +50µg Dexmedetomidine. While Group BF (n = 30), patients received 35 ml 0.375% Bupivacaine and Fentanyl 75 µg.

Preanaesthetic check up was done and investigations were noted. After obtaining informed Written consent, patient were shifted to operation theatre. All standard monitors were applied. Patients were given full knowledge about the procedures & after skin preparation under all aseptic precautions brachial plexus block was performed under Ultrasonographic guidance using a linear probe (6-13MHz). Nerve location was performed using a 22 G, 5 cm long, short beveled stimplex needle. Needle was advanced along the longitudinal axis of ultrasound transducer from lateral to medial direction, so that entire shaft of the needle would lie in the path of ultrasound beam and both the needle shaft and tip could be visualized. After negative aspiration of air and blood, drug was injected & proper spread of drug around the plexus was continuously evaluated.

The time of giving the drug was noted. Sensory block was assessed by pinprick (22 G hypodermic needle) using a sensory score, where 0 taken as normal sensation to pin prick, 1 = dull response to pin prick, 2 = no response to pin prick. Onset of sensory block was taken as the time taken from the end of injection to the first no response to pinprick in the distribution of any three sensory nerves in hand.

Motor block was assessed by checking movements at elbow, wrist and fingers using a motor score where 0 taken as normal motor functions with full flexion and extension at elbow, wrist and finger, 1 = decreased motor strength with ability to move fingers only, 2 complete motor blockade with inability to move fingers. Onset of motor block was taken as the time from end of injection until onset of complete loss of motor power. Patient showing 0 sensory and motor score even after 30 minutes of drugs injections were considered as failure cases & were given general anesthesia and these cases were excluded from the study.

Duration of sensory block was taken as the time between onset of sensory block and appearance of pain requiring analgesia. Duration of motor block was recorded as the time taken between onset of motor block to complete return of motor power.

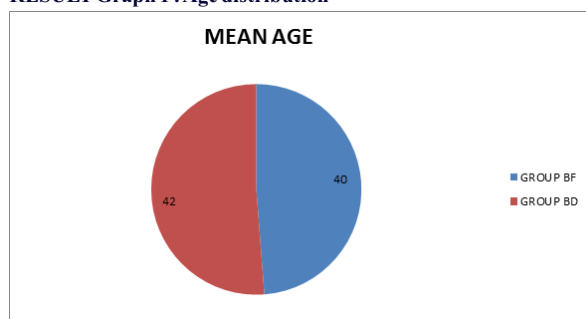
Pain was assessed using visual analog scale (VAS) where 0 = no pain and 10 = worst imaginable pain. Good pain relief is defined as VAS score < 4. Once this score is reached, rescue analgesic inj. Tramadol (1.5mg/kg) IV was given.

In post op recovery room, Heart rate, Mean Arterial Pressure, VAS, Ramsay Sedation Score, Time taken for first rescue analgesic, was recorded at 2, 6, 12, 18, 24, 36, 48 hrs postoperatively

Statistical Analysis

After collecting data from both the groups mean and standard deviation was calculated using MS EXCEL software for demographic data like age, sex, onset and duration of sensory and motor blocks, VAS SCORE and RAMSAY SEDATION SCORE. To determine the statistical significance for above mentioned parameters unpaired t-test was applied using GRAPHPAD software and p value was calculated. P value < 0.05 taken as significant.

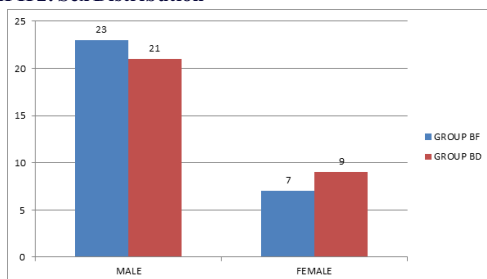
RESULT Graph 1 : Age distribution



The patients in Group BD were compared with Group BF in terms of demographic profile.

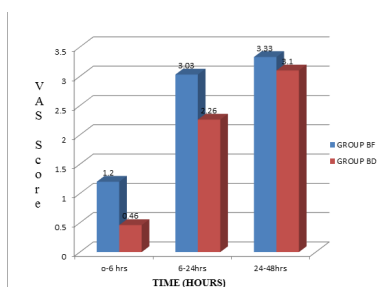
As shown in Graph 1, Mean age of the two group were statistically comparable. Group BF with mean age group (40±16.5) and group BD with mean age group (42±13.2) has p value < 0.606 which > 0.05 so is not statistically significant.

GRAPH 2: Sex Distribution



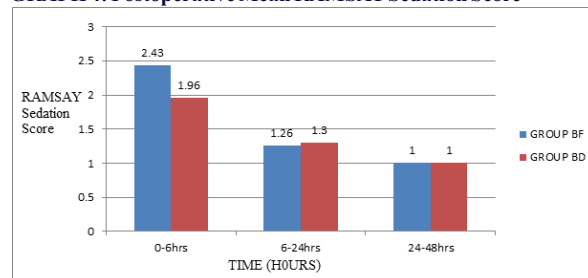
Similarly as shown in Graph 2 Group BF had 23 male and 7 female and group BD had 21 male and 9 female. All patients were operated for upper limb surgery, so we noted that demographic data like age, sex and type of surgery of both the groups were comparable and not statistically significant.

GRAPH 3: Postoperative Mean VAS Score



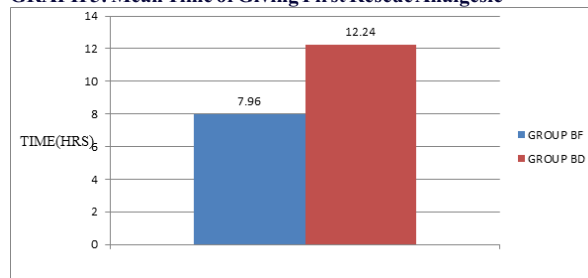
Graph 3 shows mean VAS Score at different time interval of both BF and BD group. In our study, VAS score of group BD at 0-6 hrs (0.46±0.62) and VAS score at 6-24hrs (2.26±0.78) was significantly lower than group BF having VAS (1.20±1.06) at 0-6 hrs and VAS (3.03±0.77) at 6-24 hrs as p value < 0.0017 for 0-6 hrs and < 0.0002 for 6-24 hrs which was calculated by applying unpaired t test using GRAPHPAD software is < 0.05. No significant difference noted in 24 to 48 hrs.

GRAPH 4: Postoperative Mean RAMSAY Sedation Score



As shown in Graph 4 Group BF has significantly more sedation score (2.43±0.50) than Group BD (1.96±0.49) at 0-6 hrs with p value < 0.005. After that, till 48 hrs the difference was not significant.

GRAPH 5: Mean Time of Giving First Rescue Analgesic



Graph 5 shows mean time of giving first rescue analgesic in group BD and BF which was about (12.24±1.30) hrs in group BD and (7.96±1.03) hrs in group BF which is statistically significant as p value is < 0.0001 which is < 0.05.

TABLE 1: Onset of Sensory and Motor Block (Minutes)

ONSET OF BLOCK (minutes)	GROUP BF	GROUP BD	P VALUE
SENSORY	6.033±1.12	9.33±1.66	<0.0001
MOTOR	7.93±1.55	12.20±1.62	<0.0001

Table 1 shows onset of sensory and motor block in terms of mean±SD of the two groups. unpaired t test was applied and p value was calculated using GRAPHPAD software. Onset of block is slower in group BD than group BF which is statistically significant as p value is < 0.05.

TABLE 2: Duration of Sensory and Motor Block (Hours)

DURATION OF BLOCK (HOURS)	GROUP BF	GROUP BD	P VALUE
SENSORY	7.96±1.03	12.24±1.30	<0.0001
MOTOR	6.96±0.99	10.53±1.35	<0.0001

Table 2 shows duration of sensory and motor block in terms of mean±SD of the two groups. Unpaired t test was applied and p value was calculated using GRAPHPAD software. Duration of sensory and motor block is more in dexmedetomidine group which is statistically significant as p value is < 0.05.

DISCUSSION

Brachial plexus block is good alternative to general anaesthesia for upper limb surgeries avoiding untowards effects of general anaesthesia drugs and upper airway instrumentation. With addition of adjuvant to local anaesthesia, block can be prolonged to cover lengthy surgeries and to provide postoperative analgesia.⁵ In our prospective, randomized and comparative study we have used Fentanyl versus Dexmedetomidine as an adjuvant to Bupivacaine in brachial plexus block. The demographic profile like age, sex, type of surgery between the two groups were statistically insignificant (p > 0.05) which provide

us the uniform platform to evenly compare the results obtained.

Addition of opioids like Fentanyl, Tramadol increases the duration of sensory and motor block with better postoperative analgesia. Madhusudan *et al.*⁶ studied the effect of adding Fentanyl or Tramadol to Ropivacaine in supraclavicular brachial plexus block for upper limb orthopedic surgeries. They concluded that there is significant beneficial effect from addition of opioids to local anesthetics on duration of sensory, motor blockage and VAS scores compared to plain ropivacaine alone. Similarly, Fatma Gad EL-rab *et al.*⁷ in their study on addition of 1 µg/kg fentanyl to 0.5% Bupivacaine, found that it significantly prolongs the duration of sensory and motor blockage than 0.5% Bupivacaine alone. Two possible mechanism of action for this improved quality of block can be, firstly due to peripheral effect of opioids. The lipid solubility of fentanyl may have perineural effect and fentanyl is also reported to have local anaesthetic action.⁸ second, fentanyl may potentiate local anesthetic action via central opioid receptor mediated analgesia by peripheral uptake of fentanyl to systemic circulation.⁹

Dexmedetomidine, an alpha 2 adrenergic receptor act like Clonidine. It is highly specific and selective to alpha 2 receptor. K. Kaygusuz *et al.*¹⁰ in their study added 1 µg/kg Dexmedetomidine in Levobupivacaine 5% 39 ml for performing axillary block and found that it shortens sensory block onset time and increases the sensory and motor block duration & time to first analgesic use and decreases total analgesic use with no side effects compared to plain Levobupivacaine alone. Anjan Das *et al.*¹¹ in their study used Dexmedetomidine 100 µg with 30 ml 0.5% Ropivacaine in supraclavicular brachial plexus block found that onset of both motor and sensory block was earlier in Dexmedetomidine group but they were not clinically significant as ($p > 0.05$) whereas sensory and motor block duration significantly greater in Dexmedetomidine group.

Possible mechanism for such effect of dexmedetomidine as an adjuvant explained by Lee *et al.*¹², Talke *et al.*¹³ and Yoshitomi *et al.*¹⁴ were that Dexmedetomidine induces vasoconstriction through an action on alpha 2 adrenoreceptors or it produces analgesia peripherally by reducing norepinephrine release and increasing the potassium conduction in C and A-delta neurons responsible for pain stimulus whereas it produces analgesia and sedation centrally by inhibition of substance P release in nociceptive pathway at the level of dorsal root ganglia and locus coeruleus.

In our study onset of sensory block is about (6.03±1.66) min in group BF and (9.33±1.66) min in group BD and onset of motor block is about (7.93±1.55) min in BF group and (12.20±1.62) min in BD group which is similar to studies performed by Soma C. Cham *et al.*¹⁵ in which 30 ml 0.5% Ropivacaine was used in two groups with 50 µg Fentanyl and 50 µg Dexmedetomidine respectively. Group Fentanyl Ropivacaine has early onset of sensory and motor block than group Ropivacaine and Dexmedetomidine. Pradeep Sahi *et al.*¹⁶ performed study on 3 groups of 40 patients each on comparative evaluation of the effects of Fentanyl and Dexmedetomidine as an adjuvant in supraclavicular brachial plexus block also had similar results that is onset of both motor and sensory block was less in Fentanyl group compared to Dexmedetomidine and plain Ropivacaine group.

However, in studies conducted by Ahmed A. Metwally *et al.*¹⁷ in which 0.5 % Bupivacaine 25ml with 100 µg Fentanyl and 100 µg Dexmedetomidine were used in infraclavicular block & Mohamed Ahmed *et al.*¹⁸ used 0.5% Bupivacaine (0.5ml/kg) maximum 40 ml with 1 µg/kg Fentanyl and 1 µg/kg Dexmedetomidine onset of sensory and motor effect of block was earlier in Dexmedetomidine group than Fentanyl group. Also study of P.Dharmarao *et al.*¹⁹ no significant difference was noted in onset of block between Fentanyl and Dexmedetomidine group. Difference in local anesthetics, their concentration, varying doses of Dexmedetomidine and fentanyl, different approaches of brachial plexus used and different assessment methods could have led to such diverging observation.

Increased total duration of sensory and motor blockage and prolonged post-operative analgesia in Dexmedetomidine group than Fentanyl group was observed in all the above studies.¹⁵⁻¹⁹, which is similar to our study in which group BD has sensory block duration of about (12.24±1.30) hrs and group BF has sensory block duration of about (7.96±1.03) hrs and motor block duration in group BD is (10.53±1.35) hrs and in group BF is (6.96±0.99) hrs both of which is

statistically significant as p value < 0.0001 . Mean time of giving first rescue analgesic in Dexmedetomidine group was around (12.24±1.30) hrs and in Fentanyl group was around (7.96±1.03) hrs.

Post operatively Ramsay Sedation Score more in group BF in first 6 hrs and is statistically significant and after that no significant difference noted till 48 hrs. This can be attributed to the larger doses of Fentanyl used (75 µg) as compared to Dexmedetomidine (50 µg) and short acting nature of the drug.

No major side effects like bradycardia, hypotension, pruritis and respiratory depression were noted in our study. Technical complication of brachial plexus block such as hematoma and pneumothorax were not observed in our studies due to use of ultrasonography guided technique of block.

Major limitation of our study were that we could not measure the plasma concentration of Dexmedetomidine and Fentanyl among study patients to determine whether its action was related to systemic absorption or pure local effect and we depend upon the skills of the investigators and the use of ultrasonography guided block for proper placement of blocking needle.

CONCLUSION

Addition of both Fentanyl and Dexmedetomidine to Bupivacaine improves the quality of block without any major side effect but Dexmedetomidine is better in terms of duration of both motor and sensory blocks and postoperative analgesia. On the other side Fentanyl hasten the onset of block.

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