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Original Research Article

Comparative Study of Bupivacaine with Bupivacaine Plus Dexamethasone in Brachial Plexus Block for Upper Limb Surgeries

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Conflict of interest: Nil

Abstract:

Background: Brachial plexus block acts as sole anesthetic technique to provide painless upper limb surgery. Many approaches have been mentioned of which the classical supraclavicular approach is most common to brachial plexus for the whole upper limb surgeries because of compact arrangement of the nerve trunks. Dexamethasone is a potent synthetic member of the Glucocorticoid class of steroid drugs. When given by intrathecal or perineural injection steroids induce a degree of vasoconstriction thereby reducing the local anesthetic absorption thus prolonging their effect.

Material and Methods: This prospective, randomized controlled, clinical study was conducted with 60 patients posted for elective upper limb surgeries having expected duration of surgery of 150 mins. Patients were randomly divided into two groups of 30 patients. Group S received Inj. 0.5% bupivacaine 23 ml plus 0.9% normal saline 2 ml making a total volume of 25 ml. Group D received 0.5% bupivacaine 23 ml plus dexamethasone 2 ml (8 mg) making a total volume of 25 ml. the patients were observed vigilantly for any procedure related complications and for the toxicity of the drugs injected.

Result: The addition of dexamethasone to local anesthetics (Bupivacaine) in US-guided supraclavicular approach of brachial plexus block prolongs the duration of sensory, motor and time for requirement of 1st rescue analgesic.

Conclusion: the addition of dexamethasone to local anesthetics (Bupivacaine) in US-guided supraclavicular approach of brachial plexus block over plain Bupivacaine hastens the time of onset of sensory and motor blockade, hastens the time to achieve peak of sensory and motor blockade, prolongs the duration of sensory and motor blockade, delays the need of rescue analgesia and provides stable hemodynamic without any unwanted side effects in perioperative period.

Keywords: Upper Limb Surgery, Bupivacaine, Dexamethasone.

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Introduction

Brachial plexus block acts as sole anesthetic technique to provide painless upper limb surgery. Many approaches have been mentioned of which the classical supraclavicular approach is most common to brachial plexus for the whole upper limb surgeries because of compact arrangement of the nerve trunks. Ultrasound-guided Supraclavicular brachial plexus block is a safe, reliable anesthetic technique for upper-limb surgeries with less complication. Ultrasound guidance leads to decreased procedure time, faster onset of action and higher blocks success rates without neural injuries. [1] The main goal for the management of pain in post-operative cases is reducing the dose of medication to diminish the side effect while still giving sufficient analgesia.

Bupivacaine is a local anesthetics used in brachial plexus block that is lasting 3 to 6 hrs. Such duration is enough to provide intraoperative but may not enough for postoperative analgesia. Administration of adjuvants like epinephrine, opioid (morphine), alpha2 agonist (clonidine and dexmedetomidine), midazolam, corticosteroid (dexamethasone), and ketamine with local anesthetic in supraclavicular block has been proven to prolong post-operative analgesia. [2,3,4] Steroids have powerful anti-inflammatory as well as analgesic property. Dexamethasone, long acting and highly potent glucocorticoid has desirable properties of stable hemodynamics, no sedation, no respiratory depression, along with potentiating and prolonging the duration of analgesia through its (i) vasoconstrictive effect there by reducing the local anesthetics absorption and (ii) increasing the activity of inhibitory potassium channels on nociceptive C-fibers (via glucocorticoid receptors), thus decreasing their activity without any unwanted side effects. It is widely believed that dexamethasone improves the quality and duration of peripheral nerve block over local anesthetic alone. This is thought to be mediated by attenuating the release of inflammatory mediators, reducing ectopic neuronal discharge and inhibiting potassium channel-mediated discharge of nociceptive C-fibers. [5,6,7] The present study was performed to evaluate the efficiency of dexamethasone when administered with a mixture of 0.5% bupivacaine in US-guided supraclavicular approach of brachial plexus blockade on post-operative analgesia. Onset, peak effect of sensory and motor blockade, duration of sensory and motor blockade and time of 1St rescue analgesia as well as peri-operative hemodynamic changes and side effects were also studied.

Materials and Methods

This prospective, randomized controlled, clinical study was conducted with 60 patients posted for elective upper limb surgeries having expected duration of surgery of 150 mins. Patients aged between 18 and 60 years with ASA grades I and II undergoing who were planned to undergo lower arm, elbow and forearm Surgeries (only elective) under supraclavicular brachial plexus block were included in the study. The study excluded Pregnant women, patients with History of local anesthetics allergy, Peripheral neuropathy, Patient with psychiatric behaviors, Bleeding disorder, Patients on anticoagulants, Neurological deficit involving brachial plexus, Local infection at the injection site. Each Patients were randomly divided into two groups of 30 patients each According to the local anesthetic mixture they received by computer generated method.

Group S: Inj. 0.5% bupivacaine 23 ml plus 0.9% normal saline 2 ml making a total volume of 25 ml.

Group D: received 0.5% bupivacaine 23 ml plus dexamethasone 2 ml (8 mg) making a total volume of 25 ml.

After explaining the procedure properly, a written informed consent was taken from all the patients of the study. Each patient was explained in detail regarding the procedure of anesthesia and Visual Analogue Scale (VAS) was explained on a sheet of paper where a score of 0 labelled as no pain and 10 as worst possible pain. [8]

Before the procedure, intravenous access was secured on the contralateral hand and monitors for heart rate, NIBP, ECG, SpO2 were applied and baseline vital parameters were recorded. All patients were pre-medicated with Inj. Glycopyrrolate 0.04mg/Kg intravenously and Inj. Ondansetron 0.1mg/Kg Intravenously. On the operation table, the patient was given the position for brachial plexus block via supraclavicular approach. In supine position with the patient's head turned away from the side to be blocked. The arm to be anaesthetized is adducted and the hand extended along the side towards the ipsilateral knee as far as possible. Under all aseptic and antiseptic precaution local site was painted and draped. An Ultrasound machine with linear transducer was used for localization of the brachial plexus. The transducer is positioned in the transverse plane immediately proximal to the clavicle, slightly posterior to its midpoint. The transducer is tilted caudally, to obtain a cross-sectional view of the Subclavian artery. The brachial plexus is seen as a collection of hypoechoic oval structures posterior and superficial to the artery. The 23-gauge 1.5inch hypodermic needle was then inserted in plane toward the brachial plexus, in a lateral to medial direction. Upon visualizing the needle path to the desired location, the study local anesthetic mixture was injected after negative aspiration for blood and air. During the conduct of the block and thereafter, the patients were observed vigilantly for any procedure related complications and for the toxicity of the drugs injected. After injection of the local anesthetic, Onset, Peak and duration Sensory block & motor blockade on the scale of 0 to 3, Hemodynamic vitals, Intraoperative complications, Time for rescue analgesia (min) were monitored and rescue analgesic in the form of injection diclofenac 1-1.5mg/kg iv was given. The visual analogue scale (VAS), which ranges from no pain (0) to the worst pain (10), was used to measure the degree of pain Results were expressed as Mean ± SD (standard deviation). Statistical analysis was performed using student's T-test for intergroup comparison. The p-value <0.05 was taken as significant for all statistical comparisons.

Results

Table 1 shows no significant difference was seen in age, weight, sex (male and female ratio) and ASA status of patients between both the groups (p>0.05).

Table 1: Demographic Data

Parameters	Group D	Group S	p Value	Inference
Age (Years)	36.07 ± 9.93	37.47 ±10.02	0.59	NS
Weight (Kg)	66.27 ± 6.56	65.57 ± 6.77	0.69	NS
Sex(M/F)	18:12	19:11	0.79	NS
ASA Grade I&II	22&8	24&6	0.54	NS

Table 2 shows Duration of surgery in both the groups were comparable and there was no statically significant Difference (p>0.05)

Table 2: Duration of Surgery

Parameters	Group D	Group S	p Value	Inference
Duration of Surgery in mins	110.17 ± 20.28	108 ± 17.30	0.66	NS

Table 3 shows mean of onset of sensory and motor block was significantly lower in Group D as compared to Group S (p<0.05)

Table 3: Onset of Sensory and Motor Block

Parameters	Group D	Group S	p Value	Inference
Onset of Sensory Block (min)	3.90 ± 0.84	5.10 ± 0.92	<0.0001*	S
Onset of Motor Block (min)	5.50 ± 1.04	6.50 ± 0.82	0.0001*	S

Table 4 shows mean time to achieve peak (complete) sensory and motor block. The time to achieve peak (complete) sensory and motor blockade were significantly more rapid in the Group D than in the Group S (P<0.05).

Table 4: Peak of Sensory and Motor Block

Parameters	Group D	Group S	p Value	Inference
Peak of Sensory Block (min)	9.40 ± 0.93	11.50 ± 0.78	<0.0001*	S
Peak of Motor Block (min)	12.30 ± 1.32	15.87 ± 1.17	<0.0001*	S

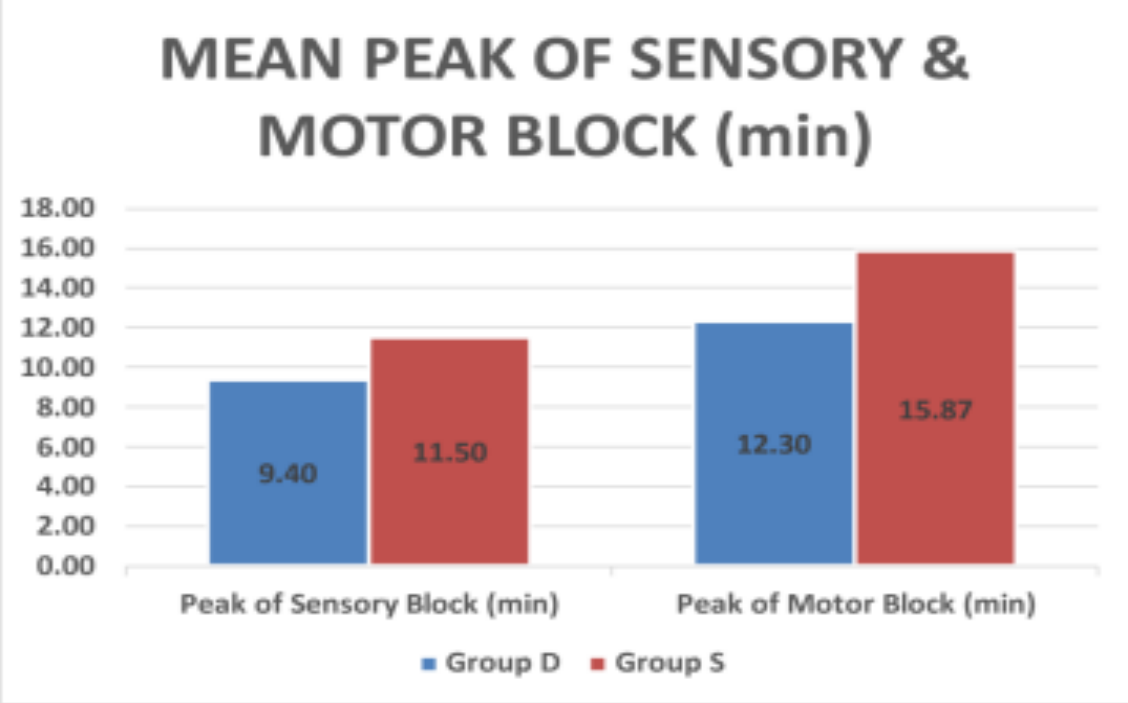

Figure 1: Mean peak of sensory & motor block

Table 5 shows perioperative heart rate and blood pressure (Systolic and Diastolic blood pressure) in patients. There was no significant difference in mean heart rate and mean blood pressure of patients of both the Group (P>0.05) and heart rate and blood pressure were stable and comparable between two groups.

Table 5: Perioperative Changes in Heart Rate and Blood Pressure

Time (Min)	Heart Rate (Per Min)		Blood Pressure (mmhg)				P value
	Group D	Group S	Group D		Group S		
	Mean±SD	Mean±SD	SBP	DBP	SBP	DBP	
PRE-OP	85.00±4.45	85.80±3.84	124.53±6.89	79.60±5.29	125.20±7.17	80.07±5.37	NS
1 min after injection of LA	91.40±3.68	90.80±2.61	126.20±6.87	78.53±4.39	126.67±8.26	78.20±5.05	NS
5 min	91.60±4.01	92.53±4.61	124.07±7.99	77.60±6.07	124.47±5.14	78.13±5.48	NS
10 min	89.73±5.22	89.60±3.34	122.17±8.28	77.27±5.05	123.00±6.47	77.67±5.44	NS
15 min	86.13±5.17	86.13±3.23	120.53±7.74	77.07±4.35	121.27±6.31	77.27±4.80	NS
30 min	80.80±5.24	81.00±4.03	119.47±7.52	78.60±3.45	121.47±7.48	78.27±5.27	NS
45 min	79.80±5.07	80.20±4.37	119.07±6.96	78.13±4.10	121.73±7.20	76.27±5.98	NS
60 min	80.47±4.89	80.73±4.08	118.40±5.67	79.33±3.94	118.07±5.79	77.60±4.88	NS
90 min	79.47±5.28	79.67±3.68	119.60±6.42	80.53±4.17	118.27±5.77	78.27±5.25	NS
120 min	79.67±4.87	81.40±4.27	119.20±5.19	80.33±4.14	118.27±5.82	78.20±5.26	NS
150 min	80.53±4.90	80.67±4.50	120.07±5.72	81.27±3.66	118.40±5.29	79.33±4.96	NS
180 min	79.73±5.58	80.00±4.84	122.93±6.82	81.67±4.37	120.87±7.31	81.20±3.92	NS
240 min	80.23±4.20	79.53±4.63	121.73±6.94	81.27±4.53	120.80±5.84	79.43±4.71	NS
300 min	81.80±7.09	81.03±6.42	123.20±7.46	81.27±4.41	120.47±4.60	80.27±3.67	NS
360 min	81.00±6.05	83.07±4.35	123.93±6.67	79.67±3.33	121.07±5.75	78.13±4.55	NS
420 min	81.60±5.05	83.40±4.27	123.33±6.00	80.73±4.44	122.07±6.53	79.07±3.67	NS
480 min	83.20±5.35	83.73±5.09	119.87±6.12	78.93±3.78	119.33±5.86	77.73±5.32	NS
600 min	82.20±5.59	84.27±5.63	120.80±7.38	79.80±3.73	121.80±7.28	78.27±5.30	NS
720 min	83.80±5.21	84.87±4.45	119.67±6.06	80.67±3.61	119.07±6.16	79.20±4.38	NS
840 min	83.27±5.32	84.93±3.96	121.40±6.63	81.67±3.90	120.60±7.07	79.87±4.52	NS
960 min	84.40±5.21	86.00±4.03	120.47±7.59	78.93±4.45	118.87±6.07	78.60±6.39	NS
1080 min	85.27±5.39	87.07±3.10	120.73±6.25	80.60±3.72	121.20±7.27	78.33±5.97	NS
1200 min	85.07±4.32	86.00±3.64	123.67±6.19	79.53±3.22	121.53±6.88	79.73±5.27	NS

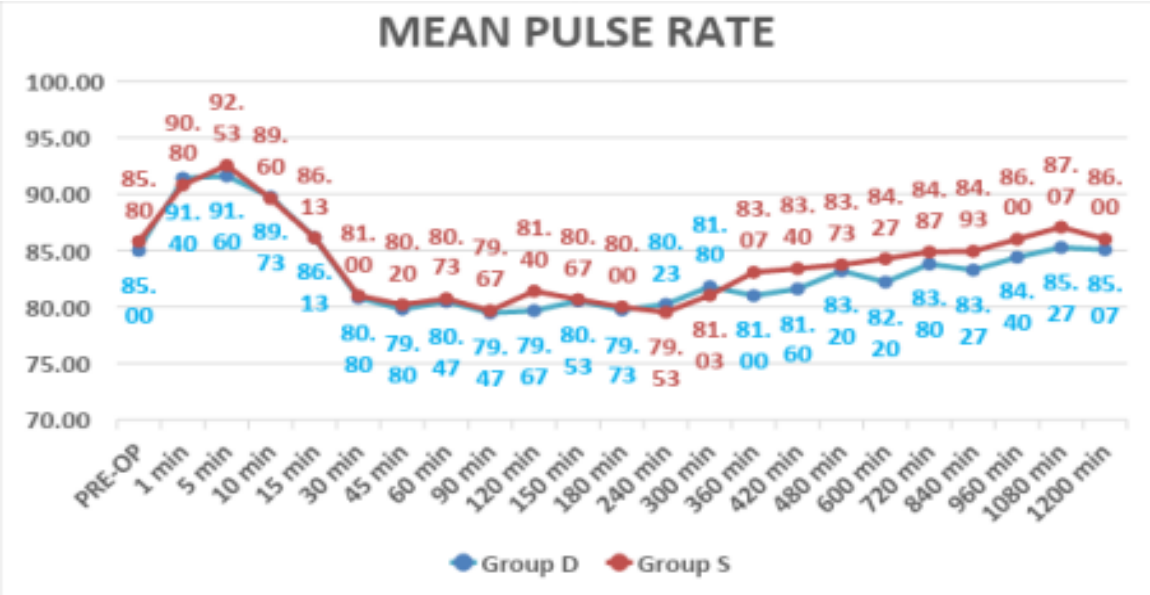

Figure 2: Mean Pulse Rate

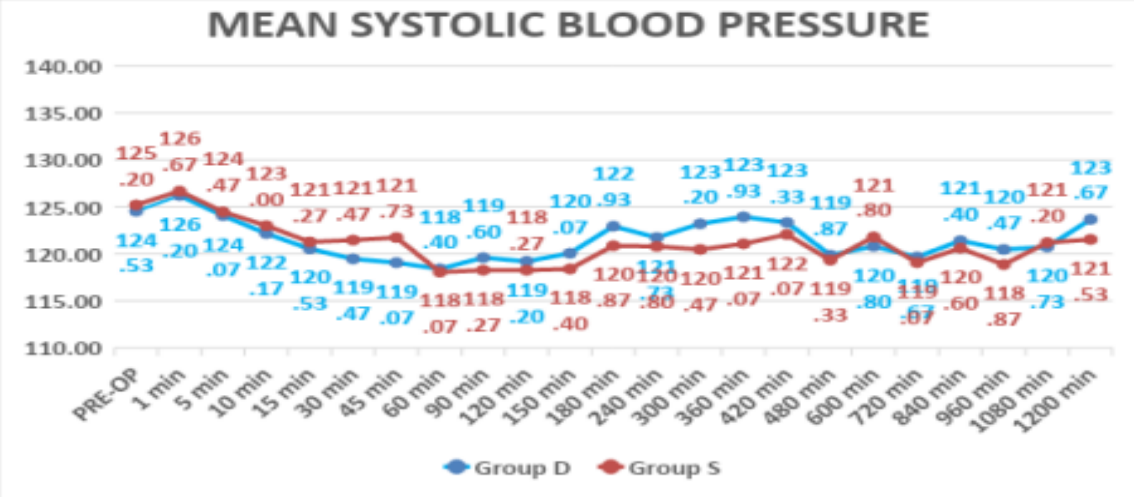

Figure 3: Mean systolic blood pressure

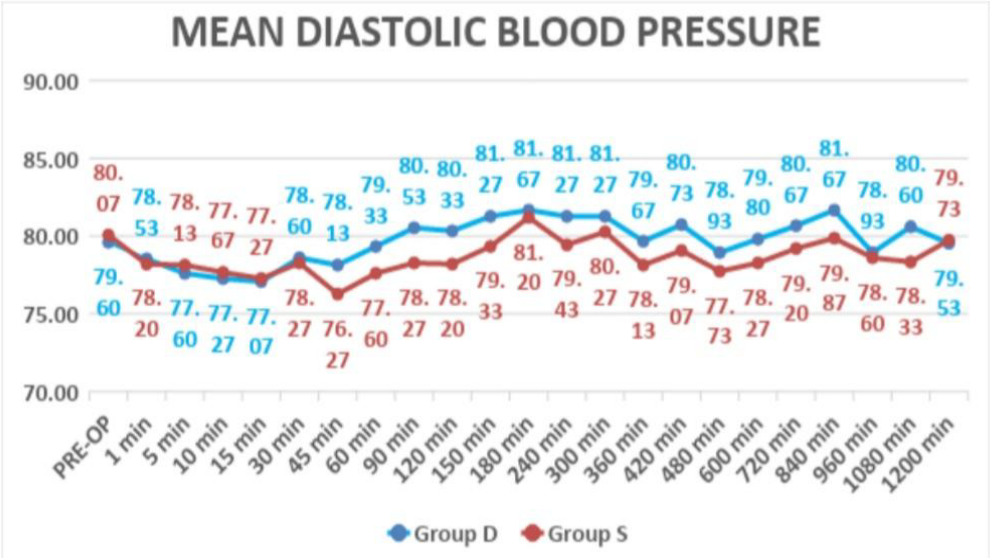

Figure 4: Mean diastolic blood pressure

Table 6 shows mean respiratory rate and spo2 (Oxygen saturation) of patients in perioperative period. There were no significant difference in mean respiratory rate and spo2 of patients of both the groups (P>0.05), respiratory rate and spo2 were stable and comparable between two groups.

Table 6: Perioperative Respiratory Rate and Spo2 Changes

Time (Min)	Respiratory Rate (Per Min)		SPO2 (IN %)		P Value
	Group D	Group	Group D	Group S	NS
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	NS
PRE-OP	16.50±1.22	16.03±1.13	98.80±0.41	98.83±0.38	NS
1 min after injection of LA	17.33±0.99	17.13±1.11	98.93±0.25	98.97±0.18	NS
5 min	17.57±0.73	17.60±0.77	98.87±0.35	98.93±0.25	NS
10 min	17.00±1.23	17.07±1.20	98.93±0.45	99.00±0.37	NS
15 min	16.67±1.32	16.77±1.38	99.00±0.00	98.97±0.32	NS
30 min	16.63±1.35	16.73±1.41	99.00±0.00	98.97±0.18	NS
45 min	16.67±1.32	16.77±1.38	99.00±0.00	99.00±0.00	NS
60 min	16.63±1.35	16.73±1.41	99.00±0.00	99.00±0.00	NS
90 min	16.80±1.21	16.73±1.36	99.00±0.00	99.00±0.00	NS
120 min	16.60±1.38	16.57±1.38	99.00±0.00	99.00±0.00	NS
150 min	16.73±1.26	16.77±1.38	99.00±0.00	99.00±0.00	NS
180 min	16.70±1.37	16.73±1.41	99.00±0.00	99.00±0.00	NS
240 min	16.70±1.29	16.77±1.38	99.00±0.00	99.00±0.00	NS

300 min	16.63±1.35	16.73±1.41	99.00±0.00	99.00±0.00	NS
360 min	16.67±1.32	16.77±1.38	99.00±0.00	99.00±0.00	NS
420 min	16.63±1.35	16.73±1.41	99.00±0.00	99.00±0.00	NS
480 min	16.67±1.32	16.77±1.38	99.00±0.00	99.00±0.00	NS
600 min	16.70±1.37	16.73±1.41	99.00±0.00	99.00±0.00	NS
720 min	16.80±1.27	16.77±1.38	99.00±0.00	99.00±0.00	NS
840 min	16.67±1.37	16.73±1.41	99.00±0.00	99.00±0.00	NS
960 min	16.67±1.21	16.70±1.26	99.00±0.00	99.00±0.00	NS
1080 min	16.67±1.32	16.70±1.29	99.00±0.00	99.00±0.00	NS
1200 min	16.53±1.36	16.57±1.41	99.00±0.00	99.00±0.00	NS

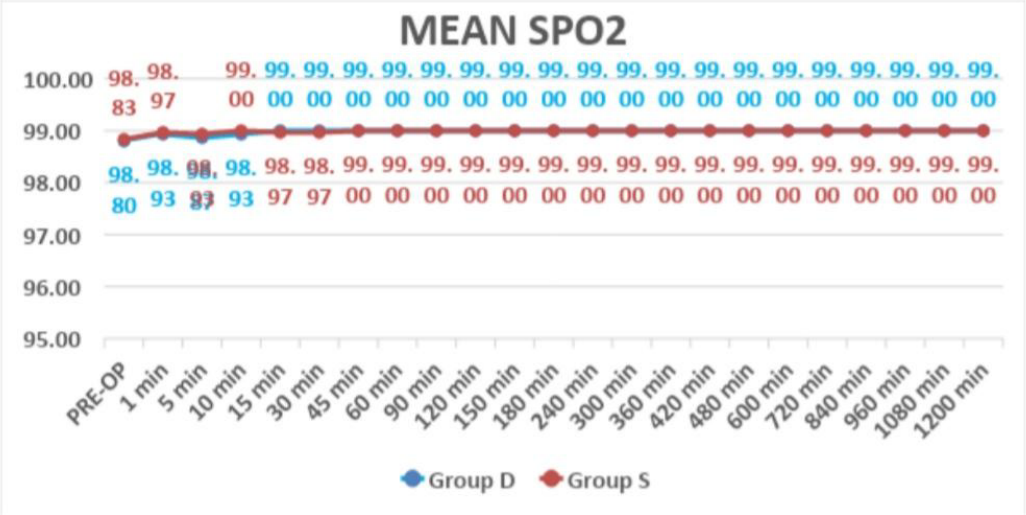

Figure 5: Mean SpO_2

Table 7 shows mean time of duration of motor block, mean time of duration of sensory block and mean time of 1st rescue analgesia. The duration of motor blockade, duration of sensory blockade and time of 1st rescue analgesia were significantly longer in the Group D than in the Group S(P<0.05).

Table 7: Duration of Motor & Sensory Block and Time of First Rescue Analgesia

Parameters	Group D	Group S	P value	inference
Duration of Motor Block (min)	598.17 ± 28.05	460 ± 22.89	<0.0001	S
Duration of sensory block(min)	807.50±24.45	510±17.86	<0.0001	S
Time to first rescue analgesia(min)	1010 ± 40.66	580 ± 24.91	<0.0001*	S

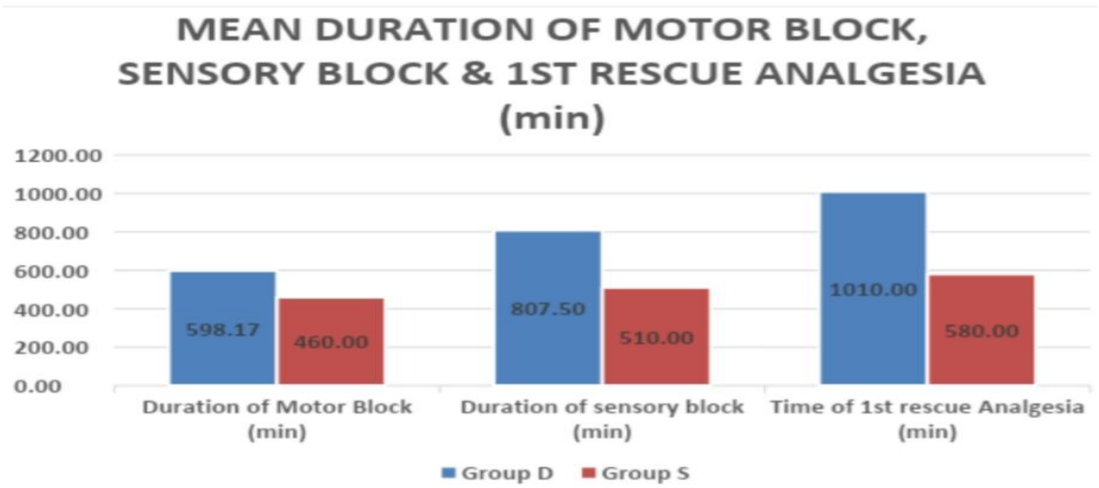

Figure 6: Mean duration of motor block, sensory block & 1st rescue analgesia

Perioperative Complication (If Any)

Any complications related to drugs and procedure, hemodynamic and neurological complications were not seen in either of the groups. Only one patient from group S had shivering in intraoperative period for which no pharmacological interventions were required only treated with warm blanket.

Discussion

In our study, the time of onset of sensory and motor block was significantly faster in dexamethasone group ($p<0.05$) and in both the groups the onset of sensory block was earlier than motor blockade. Our results correlate with the finding of other study with earlier onset of sensory block than motor block.

Nilesh M. Solanki et al (2017) in their study injected 32 ml of mixture of 1.5% lignocaine-adrenaline 10 ml, 0.5% bupivacaine 20ml and normal saline 2 ml, whereas in group D, patients received the same amount of local anesthetics with dexamethasone 2 ml (8mg) and reported that mean onset time of sensory block was 4.24 ± 1.42 min in control group and 3.24 ± 1.09 min in dexamethasone group. The mean onset time of motor block was 7.52 ± 1.50 min in control group and 6.2 ± 1.44 min in dexamethasone group. The difference was statistically significant ($p<0.05$).

The time to achieve peak sensory block and motor block was significantly faster in dexamethasone group compared with saline group ($p< 0.05$). Ramakrishna shatagopam et al(2019) concluded that addition of 28ml bupivacaine (0.5%) + 2ml normal saline in Group I and 28ml bupivacaine (0.5%) + 2ml dexamethasone (8mg) in GROUP II and reported that mean duration of peak of sensory blockade in control group was 17.4 ± 3.5 min and in dexamethasone group was found to be 11.8 ± 2.7 min and the mean duration of peak of motor blockade in control group was 8.5 ± 4.4 min and in dexamethasone group was found to be 6.4 ± 1.8 min. [9]

We observed that adding dexamethasone to plain bupivacaine (0.5%) significantly prolongs the effect of motor and sensory block and also delays the time for the need of rescue analgesia in supraclavicular block.

Ramakrishna shatagopam et al (2019) performed a comparative study of bupivacaine and bupivacaine with dexamethasone combination in brachial plexus block by supraclavicular approach and found that mean duration of sensory blockade in was 2.3 ± 1.4 hours in normal saline group and was found to be 5.85 ± 0.84 hours in dexamethasone group and the mean duration of motor blockade was 2.48 ± 0.59 hours in normal saline group and was found to be 6.97 ± 0.47 hours in dexamethasone Group. [9] There was no significant difference in the hemodynamics found between the two groups perioperatively. During intraoperative period, hemodynamics remained stable in consistent manner, thereby reducing any anxiety related fluctuations in the vitals.

M.P. Golwala et al (2009) demonstrated in their study that, no significant difference in both group of study in terms of hemodynamic variables like pulse, blood pressure, Spo2. [10]

Conclusion

The addition of dexamethasone to local anesthetics (Bupivacaine) in US-guided supraclavicular approach of brachial plexus block over plain bupivacaine hastens the time of onset of sensory and motor blockade, hastens the time to achieve peak of sensory and motor blockade, It prolongs the duration of sensory and motor blockade, It

delays the need of rescue analgesia and provides stable hemodynamic without any unwanted side effects in perioperative period.

References

1. K. C. Cummings III, D. E. Napierkowski, I. Parra-Sanchez, A. Kurz, J. E. Dalton, J. J. Brems and D. I. Sessler 2 Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine British Journal of Anaesthesia 107 (3): 446–53 (2011).
2. Dr R. G. Pathak, Dr Anand P. Satkar, DrRajendra N. Khade. supraclavicular brachial plexus block with and without dexamethasone - a comparative study International Journal of Scientific and Research Publications, Volume 2, Issue 12, December 2012 1 ISSN 2250-3153.
3. Fredrickson MJ, Krishnan S, Chen CY. Postoperative analgesia for shoulder surgery: a critical appraisal and review of current techniques. Anaesthesia 2010; 65: 608–24.
4. Hanumansetty K, Hemalatha S, Gurudatt CL. Effect of dexamethasone as an adjuvant to 0.5% evobupivacaine in supraclavicular brachial plexus block for upper extremity surgeries. Int J Res Med Sci 2017; 5:1943-7
5. Attardi B, Takimoto K, Gealy R, Severns C, Levitan ES. Glucocorticoid induced up-regulation of a pituitary K+ channel mRNA in vitro and in vivo. Receptors Channels 1993; 1: 287–93.
6. Flood P, Rathmell J, Shaffer S. Stoelting's Pharmacology and physiology in Anesthetic practice. 5th ed. Wolters Kluwer; 2017; 283-285.
7. Johanson A, Hao J. Local corticosteroid application blocks transmission in normal nociceptive c- fibers. Acta anesthesiologica 1990; 34:335-8.
8. Garra G, Singer AJ, Domingo A, Thode HC. The Wong-Baker pain FACES scale measures pain, not fear. Pediatric emergency care. 2013 Jan 1; 29(1):17- 20.
9. Ramakrishna Shatagopam, P. Anand Vijaya Bhasker. Comparision of Bupivacaine and Bupivacaine with Dexamethasone Combination in brachial plexus Block by Supraclavicular approach. Indian J Anesth Analg. 2019; 6(6 part-II):2176-2181.
10. Golwala M P, Swadia V N, DhimarAditi A, Sridhar N V Pain relief by dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block J Anaesth ClinPharmacol 2009; 25(3): 285-288.