ORIGINAL ARTICLE

Effectiveness of Dexamethasone versus Clonidine as an Adjuvant to Bupivacaine for Ultrasound-guided Supraclavicular Brachial Plexus Block in Patients Undergoing Upper Limb Surgery

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Abstract

Background: Supraclavicular Brachial Plexus Block has become one of the most important anaesthetic techniques for surgeries in the upper limb. In modern anaesthesia practices, various pharmacological agents are used as an adjuvant to provide faster onset and longer duration of analgesia of local anaesthetic agent after single injection peripheral nerve blocks. This study was designed for the evaluation of the effectiveness of dexamethasone versus clonidine as an adjuvant to bupivacaine for Ultrasound-guided Supraclavicular Brachial Plexus Block in patients undergoing upper limb surgery.

Methods: This randomized controlled trial was carried out from September 2021 to August 2022 at Dhaka Medical College and Hospital. Patients were included according to inclusion and exclusion criteria. A total of 75 patients were enrolled in the study. Patient's allocation into three groups were done by computer generation random numbers: Group A- received 18 ml of 0.5% Bupivacaine (plain) and 2 ml of normal saline. Group B- received 18 ml of 0.5% Bupivacaine (plain) with 2ml (10mg) of Dexamethasone, and Group C- received 18 ml of 0.5% Bupivacaine (plain) and 2 ml (100µg) of Clonidine. The required time for onset and duration of sensory and motor block, time for first demand of analgesia and total consumptions of analgesics within 24hours, haemodynamic parameters, and adverse effects were observed among three groups.

Result: The demographic profiles were similar between three groups ($p > 0.05$). Considering the time for complete sensory block (23.6±3.1 vs 18.9±3.2 vs 14.7±3.0) & time for the onset of maximum motor level (29.5±3.9 vs 23.5±3.1 vs 20.8±2.4), significantly less in clonidine (group C) than that of normal saline (group A) & dexamethasone (group B) group ($p < 0.05$). The Ramsey sedation score was high in group C in first eight hours during postoperative periods than two others groups which was also statistically significant ($p < 0.05$). The time to regression of sensory block (242.1±16.57 vs 932.9±44.9 vs 739.16 ±13.47) & motor block (175.6±17.5 vs 780.8±26.2 vs 570.6 ±22.0) was significantly longer in group B than that of other two group which was statistically significant ($p <0 .05$). Similarly in comparison to other two groups, group B had significantly increased (190.8±18.3 vs 810.6±25.8 vs 600.6±24.9) ($p < 0.05$) in respect of time for motor recovery. On the other hand, group B had significantly increased result in aspect of time for Ist demand of analgesic (260.6±23.0 vs 975.2±29.0 vs 760.8±25.5), significantly decreased total analgesic requirements in 24 hours (232.8±15.5 vs 84.7±13.8 & 166.1±19.4) & also significantly decreased total anti-emetic requirement in 24 hours (11.8±0.3 vs 4.1±0.8 & 8.0±0.0) ($p < 0.05$) which was statically significant than that of others two groups. All adverse effects were significantly less in group B than in groups A & group C. ($p < 0.05$).

Conclusion: Dexamethasone is more effective than clonidine as an adjuvant to bupivacaine for Ultrasound-guided Supraclavicular Brachial Plexus block.

Keywords: Dexamethasone, Clonidine, Supraclavicular brachial plexus block, Sensory block, Motor block.

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Introduction

Postoperative pain causes discomfort to the patient and also impedes the recovery. Relieving postoperative pain is the first duty of anaesthesiologist. This postoperative pain can be overcome by using suitable drugs or techniques or both. Regional anaesthetic techniques have specific advantages over both anaesthesia and analgesic supplements for intraoperative and postoperative period.

The supraclavicular brachial plexus block is a popular technique for surgeries below the shoulder joint because of its quick onset and high success rate compared to axillary and infraclavicular approaches. Moreover, a huge volume (30–40 mL) of local anesthetics used in conventional blocks may be associated with complications such as Horner's syndrome, phrenic nerve palsy, and systemic toxicity. The majority of these complications can be overcome using ultrasound-guided technique. The supraclavicular nerve block is ideal for procedures of the upper arm, from the mid-humeral level down to the hand[1]. Benefits of peripheral nerve blocks can be especially appreciated in high-risk patient populations such as those with ischemic heart disease, geriatric, obstructive sleep apnoea etc[2].

The supraclavicular brachial plexus blockade in fact reduces the pain, but due to short duration, the challenge remains to increase the duration of analgesia with decreasing side effects[3]. Different additives have been used to prolong regional blockade and shorten the onset times of blocks. Local anesthetic drugs have been traditionally used to provide anaesthesia and analgesia with any regional block technique. Additives such as opioids, tramadol, fentanyl, clonidine, verapamil, midazolam etc. were added to local anesthetics, but the results are either inconclusive or associated with side-effects[4].

Certain drugs may be used as adjuvant to local anesthetics to lower doses of each agent and enhance analgesic efficacy while reducing the incidence of adverse reactions. Tramadol and fentanyl had been successfully used as adjuvants to local anesthetic in brachial plexus block[5,6].

Since the 1980s, clonidine, an alpha2 (α2) adrenergic agonist with some α1 adrenergic properties. It has been proved that clonidine improves the effectiveness and the duration of the local anesthetic nerve blocks as well as in spinal and epidural anaesthesia. This property has been attributed to the fact that α2 adrenergic agonists enhance the nerve block of local anesthetics by facilitation of C fibre blockade, by local vasoconstriction or by spinal action caused by diffusion along the nerve or retrograde axonal transport[7]. Furthermore, clonidine enhances the action of local anesthetics by blocking the sodium channels and opening the potassium channels resulting in membrane hyperpolarization[8].

It has been reported that the duration of peripheral nerve blocks increased when clonidine was used in a dose of 1.5 μg/kg body weight provided the fastest onset of sensory as well as motor block and the longest duration of postoperative analgesia and thus is a good additive to local anesthetic solutions for brachial plexus blocks[9]. It is concluded that 150 μg clonidine is a better adjuvant to bupivacaine for supraclavicular brachial plexus block; it provides faster, longer duration of analgesia and sedation with hemodynamic stability[10]. 100 μg of clonidine with bupivacaine in ultrasound-guided supraclavicular brachial plexus blocks prolongs both sensory and motor blockade. It also provides significant postoperative analgesia and mild sedation which is beneficial in the immediate stressful postoperative period[11].

Steroids have anti-inflammatory as well as analgesic effects. Dexamethasone is a synthetic glucocorticoid has highly potent anti–inflammatory property without mineralocorticoid activity. They relieve pain by reducing inflammation and by blocking transmission in nociceptive c-fibres and suppressing ectopic neuronal discharge and it does not cause any respiratory depression[7].

The addition of dexamethasone to low volumes of bupivacaine in ultrasound-guided SBPB significantly decreased the onset time and prolonged the duration of sensory and motor blockade; also, it prolonged the duration and improved the quality of postoperative analgesia, with very few incidences of complications[12].

Two systematic reviews have shown that study participants who received a single dose of intravenous

dexamethasone perioperatively had lower pain scores and decreased opioid consumption postoperatively compared with those given placebo[13].

Perineural dexamethasone addition to local anesthetic solutions significantly improved postoperative pain in brachial plexus block without increasing complications. However, perineural adjuvant dexamethasone delayed the onset of sensory and motor block, and prolonged the duration of motor block. Smaller doses of dexamethasone (4 – 5 mg) whereas effective as higher doses (8 – 10 mg)[14].

There are no systematic reviews or meta-analyses estimating the effect of dexamethasone on BPB duration and the incidence of complications (prolonged nerve palsy, hyperglycaemia, and infection) associated with its use in the contemporary literature.

Because of the limited efficacy or questionable toxicity of the previously studied drugs, some investigators evaluated glucocorticoids as adjuvants for regional anaesthesia. Known for their anti-inflammatory, analgesic, immunosuppressive, and antiemetic properties, they exert their action by inhibiting phospholipase A2, in addition to changes in cell function induced by glucocorticoid receptor activation. Furthermore, the literature suggests that a single perioperative dose of glucocorticoid is safe[15].

Steroids induce a degree of vasoconstriction, acting like epinephrine by decreasing local anesthetic absorption. Another hypothesis is that dexamethasone may act locally on nociceptive C-fibres to increase the activity of inhibitory potassium channels, thus decreasing their activity[16].

It is thought that dexamethasone provides superior analgesia when mixed with local anesthetics for peripheral nerve blocks[13]. Similar results have also been obtained with clonidine when combined with local anesthetics like bupivacaine. This study compared the effectiveness of clonidine versus dexamethasone as an adjuvant for ultrasound guided supraclavicular brachial plexus block characteristics (onset and duration of sensory and motor blockade) and on duration of postoperative analgesia.

Methods

This randomized controlled trial was carried out between September 2021 to August 2022 in the Department of Anaesthesia, Pain, Palliative and Intensive care in collaboration with Orthopaedics & Traumatology Department, Dhaka Medical College Hospital, Dhaka. The patient who was selected for upper limb surgery fulfilling the inclusion and exclusion criteria were included as study population. Adult patients with ASA status I & II undergoing elective orthopaedic surgeries of upper limb below mid humerus under ultrasound guided supraclavicular brachial plexus block were included. The exclusion criteria were as follows: infection at injection site, known allergy to amide local anesthetic agents or study drugs, contralateral phrenic nerve palsy or pneumothorax, coagulation disorders, difficult anticipated anatomy on ultrasound, pregnant patients, physical or mental diseases which could interfere with the evaluation of pain scores and peripheral neuropathy or history taking treatment for chronic pain. Prior to the commencement of this study, the thesis protocol was approved by the Ethical Review Committee, DMCH. Informed written consent was obtained from the patient's authorized guardians after explaining every ethical issue regarding the study.

Study populations were randomized into group A, group B and group C which was achieved by computer-generated random number table. In this study Group A- received 18 ml of 0.5% bupivacaine (plain) and 2 ml of normal saline, Group B- received 18 ml of 0.5% bupivacaine (plain) with 2ml (10mg) of dexamethasone, and Group C- received 18 ml of 0.5% bupivacaine (plain) and 2 ml (100µg) of clonidine. Patient explained about the study purpose, advantage and risks of the procedure and then written consent was taken from each participant. History taking focusing clinical features, disease duration along with physical examination was done as per standard protocol. Patients were educated about the 10 cm visual analogue scale (VAS) during the preoperative assessment.

Study Procedures

On arrival to the operating room, multi-parameter monitor was attached and the initial pulses, BP, respiratory rate, SpO_2 were recorded as pre-block values. An 18 gauge IV cannula was inserted in a peripheral vein in the contralateral arm. Patients were randomly

divided into three equal groups of 25 each. Patients were divided into three groups by computer generation random numbers table. Patients of Group-A: received 18 ml of 0.5% bupivacaine (plain) and 2 ml of normal saline, patient of Group-B: received 18 ml of 0.5% bupivacaine (plain) with 2ml (10mg) of dexamethasone and patients of Group- C were received 18 ml of 0.5% bupivacaine (plain) and 2 ml (100µg) of clonidine.

The supraclavicular brachial plexus block was performed on the side of surgery in the supine position with the head turned to the opposite side and the arm placed medially towards the body after strict aseptic precautions. About 1.5 cm above the mid-clavicular point, a 22 G, 1.5 inches short bevelled needle was introduced under ultrasound guided and directed just lateral to subclavian artery pulsation in backward and medial direction. Keeping the needle in the same position, solution was injected slowly and ruling out intravascular injection intermittently by frequent aspiration through the syringe in between. The time of block was noted. The onset of sensory block was assessed with application of cold spirits swabs and by response to atraumatic prick with the blunt needle in different dermatomes, onset time was defined as dull sensation along any of the nerve distribution; the time when sensory blockade achieved was noted.

Motor blockade was evaluated by Modified Bromage scale (0 = normal motor function with full flexion and extension of elbow, wrist, and fingers; 1 = decreased motor function with ability to move the fingers only; 2 = compete motor block with inability to move the fingers) every 10 min till the onset followed by 30 min till its offset was done by on duty anaesthesiologist. The onset of motor block was defined as the time between administering the drug to the time the Bromage scale was 2. Surgery was started after the onset of both sensory and motor components of the block. After end of the surgery the patients were shifted to post anaesthesia care unit (PACU).

During PACU period data were collected by on duty anaesthesiologist. The duty anaesthesiologist was educated how to collect and record data during PACU period. The duty anaesthesiologist was also conceal about the drug preparation.

Patients were not be given any sedation during the study period. Pulse rate, blood pressure, respiratory rate, saturation, and sedation (evaluated according to The Ramsay sedation scale (RSS) was recorded every 15 min for the first hour followed by every 30 min interval up to the end of surgery. Again, the RSS was assessed during the assessment of VAS score in postoperative period. Postoperatively sedation recorded every hour interval for first 2 hours than 2 hours interval up to 24 hours.

Pain was assessed with visual analogue scale (VAS, 0–100 mm) pain scores at rest every in 15 min for the first hour followed by every 30 min intraoperatively up to end of surgery. Then VAS was reassessed at Ist and 2nd hour than two hours interval up to 24 hours during postoperative period. Adverse effects such as nausea and vomiting, shivering, dizziness, hypotension and bradycardia were recorded during perioperative period. The following vital signs were recorded including heart rate, respiratory rate, oxygen saturation and NIBP at two hours interval up to 24 hours during postoperative period.

The time for demand of analgesia that was, the period from the administration of the block till the time the patient complained of pain (VAS≥4) was recorded postoperatively in each patient. Injection pethidine (1-1.5mg/kg) was administered intramuscularly as demand of analgesic. Injection ondansetron was given 4mg intravenously before administration of pethidine and if patients complain postoperative nausea or vomiting. The total amount of pethidine and antiemetic was required in first 24 hours during the postoperative period was recorded for each of the group. All data were recorded in data collection form for each patient. Finally, the data were calculated by the help of statistician.

Statistical analysis:

Data were statistically described in terms of mean ± standard deviation (±SD), or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups were done using Student t- test for independent samples. For comparing categorical data, Chi square was performed. Inter group analysis was done by ANOVA. The F value more than 10 and p values less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 26 for Microsoft Windows.

Results

For this prospective randomized controlled study total 75 patients were selected by inclusion and exclusion criteria than they were divided into three groups by computer generated random numbers tables. Where each group was containing equal 25 numbers of patients. But during performing ultrasound guided SBPB: in group A two the patients were diagnosed as failed block. In group B one of the patients was diagnosed as failed block and group C had one block failure. As per criteria they all were excluded from the study. So, finally data of 23 in group A, data of 24 patients in group B and data of 24 patients in group C were analyzed: overall data of 71 patients were analyzed.

The mean age in group A was (47.4±6.2) years, in group B was (44.1±7.5) yrs. and group C was (45.7±6.5) yrs. Others characteristics like height, weight, gender had no significant difference was found between the three groups as p value was > 0.05. Most of the patients of all three groups (56% in group A, 48% in group B and 44% in group C) were belonging to ASA class II. But there was no statistical difference was found between the three groups as p value was > 0.05. There had no significant difference in case of block failure between the three groups. But group A had 8% block failure rate. Table I showed the demographic and clinical profile of the studied population.

Table I: Distribution of demographic and clinical status of the studied groups (n=75)

Characteristics		Group A (n=25)	Group B (n=25)	Group C (n=25)	p value			F-value
					A vs B	B vs C	A vs C	
Age (19-59) yrs		47.4±6.2	44.1±7.5	45.7±6.5	0.682	0.438	0.623	2.96
Height(cm)		156.3±7.4	154.8±6.4	158.4±7.8	0.740	0.670	0.560	2.48
Weight(kg)		65.2±5.1	64.8±5.7	66.1±6.0	0.579	0.535	0.541	3.17
Duration of surgery (min)		93.8±12.5	97.6±14.7	96.1±12.8	0.644	0.629	0.581	3.66
Gender	Male	16(64%)	14(56%)	17(68%)	0.341	0.368	0.363	3.29
	Fe - male	9(36%)	11(44%)	8(32%)	0.438	0.415	0.463	2.81
ASA class	I	11(44%)	13(52%)	14(56%)	0.389	0.425	0.486	2.49
	II	14(56%)	12(48%)	11(44%)	0.485	0.445	0.499	3.59
Numbers of failed block		2(8%)	1(4%)	1(4%)	0.543	0.562	0.623	2.41

Values are expressed as Mean±SD and within parenthesis percentage (%) over column in total.

After giving SBPB the VAS score was reduced in all the three groups. So, patients receiving clonidine with bupivacaine in SBPB had rapidly decrease pain immediate after block than group B and group A (Table II).

Table II: Comparison of the VAS scores between groups during pre and per-operative period. (n=71)

Interval	Group A (n=23)	Group B (n=24)	Group C (n=24)	P value			F-value
				A vs B	B vs C	C vs A	
Before Block	6.3±1.5	5.8±1.1	6.1±1.2	0.438	0.451	0.575	4.52
15 min	4.3±1.2	2.7±0.7	2.2±0.6	0.012[s]	0.600	0.016[s]	16.1
30 min	1.8±0.6	1.7±0.3	1.5±0.2	0.516	0.575	0.530	4.90
45 min	1.2±0.4	1.1±0.2	0.8±0.1	0.573	0.560	0.536	3.81
60 min	0.6±0.10	0.5±0.07	0.5±0.1	0.459	0.450	0.430	3.48
90 min	0.6±0.07	0.5±0.03	0.4±0.01	0.226	0.230	0.250	3.50
120 min	0.5±0.06	0.5±0.02	0.5±0.03	0.278	0.273	0.270	4.25

Values are expressed as Mean±SD.

The postoperative VAS score was high in group A at 6th hour, 14th hours and 20th hours than two others groups. In group C VAS score was high at 12th and 18th hours than the others group. But in group B VAS score was high only at 16th hours in first 24hours of postoperative periods. Which were statistically significant as $p<0.05$. When data were compared between three groups, F-value was observed >10. VAS score was decreased after giving rescue analgesia in all of the groups. So, patients receiving dexamethasone with bupivacaine in SBPB had filling less pain during the postoperative periods as VAS score was only one time cross more than 5 and patient was needed rescue analgesia for one time only. (Table- III)

Table III: Comparison of the VAS scores between groups during postoperative period. (n=71)

Interval	Group A (n=23)	Group B (n=24)	Group C (n=24)	p value			F-value
				A vs B	B vs C	C vs A	
1st hours	1.1±0.3	0.8±0.07	1.1±0.4	0.586	0.527	0.534	3.75
2nd hours	2.2±0.8	1.1±0.2	1.4±0.5	0.270	0.490	0.155	3.92
4th hours	2.7±1.6	1.4±0.5	1.8±0.7	0.256	0.386	0.139	4.72
6th hours	5.5±1.9	1.6±0.7	2.2±0.8	0.002[s]	0.519	0.006[s]	22.5
8th hours	3.6±1.5	1.7±0.8	3.3±1.2	0.258	0.186	0.642	5.28
10th hours	3.5±1.6	1.8±0.9	3.4±1.2	0.288	0.189	0.656	4.19
12th hours	3.5±1.4	2.3±0.9	5.6±1.8	0.245	0.016[s]	0.030[s]	17.8
14th hours	5.6±2.3	3.6±1.6	3.3±1.4	0.018[s]	0.635	0.015[s]	17.0
16th hours	3.3±1.6	5.09±2.1	2.8±1.3	0.025[s]	0.018[s]	0.462	15.8
18th hours	2.7±1.2	2.8±1.2	5.1±1.9	0.518	0.014[s]	0.018[s]	16.5
20th hours	5.5±1.8	2.6±0.8	3.4±1.5	0.022[s]	0.371	0.025[s]	15.2
22nd hours	2.8±1.3	2.6±0.8	3.1±0.9	0.632	0.316	0.271	3.91
24th hours	2.6±1.4	2.5±1.2	2.9±1.8	0.755	0.828	0.686	4.75

Values are expressed as Mean±SD.

Considering the characters of the block significant results found in case of time for complete sensory block and the onset of maximum motor level in between groups ($p < 0.05$). The time for complete sensory block was lowest in group C in compared to group A and group B ($p < 0.05$). On others hand the time for onset of maximum motor level was also lower in group C then group A and group B ($p < 0.05$). No significant results found in the onset of sensory and motor block ($p > 0.05$). Figure 1 showed the time of onset of sensory block, motor block and complete sensory block and onset of maximum motor level between three groups.

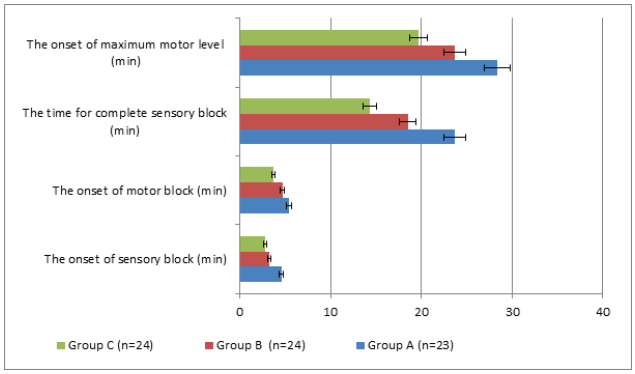

Figure 1: Time of onset of sensory block, motor block and complete sensory block and onset of maximum motor level between three groups

When considering the time of first demand of analgesia (minute) between three groups, it was longer in group B (975.2±29.0min) than group A (260.6±23.0) and group C (760.8 ±25.5min) ($p < 0.05$). So, patients receiving dexamethasone with bupivacaine provided longer duration of analgesia than clonidine.

Total opioid requirement and total anti-emetic requirement in 1st 24 hours (mg) was higher in group A (232.8±15.5mg & 11.8±0.3mg) than group B (84.7±13.8mg & 4.1±0.8 mg) and group C (166.1±19.4mg & 8.0±0.0mg) that showed the patients were receiving dexamethasone with bupivacaine in Ultra-sound guided SBPB had lowest opioid and total anti-emetic requirement in 1st 24 hours which were statistically significant ($p < 0.05$). (Figure 2)

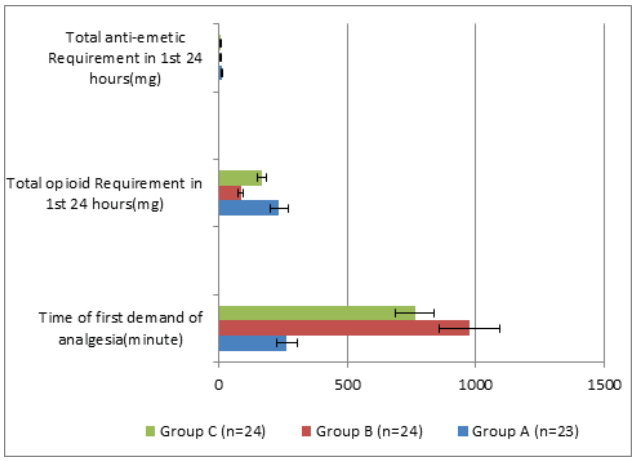

Figure 2: Time of first demand of analgesia and total opioid and anti-emetic requirement between groups

Adverse effects like nausea (17.4%), dizziness (30.4%) and shivering (26.1%) were higher in group A then group B and group C. In group C hypotension (20.8%) and bradycardia (16.7%) was more than group A and group B. All over perioperative adverse effects were less in group B than any others group. So, the patients were receiving dexamethasone with bupivacaine in ultrasound guided SBPB had lowest perioperative complication than patients who receiving clonidine in ultrasound guided SBPB. When the complications were compared between three group by ANOVA, F-value was >10. (Table-IV)

Table IV: Per and post-operative adverse effects of the patients between groups. (n=71)

Complications	Group A (n=23)	Group B (n=24)	Group C (n=24)	p value			F-value
				A vs B	B vs C	C vs A	
Nausea	4(17.4%)	1(4.2%)	3(12.5%)	0.008[s]	0.017[s]	0.178	16.9
Hypotension	2(8.7%)	2(8.3%)	5(20.8%)	0.346	0.0013[s]	0.012[s]	17.8
Bradycardia	2(8.7%)	1(4.2%)	4(16.7%)	0.173	0.014[s]	0.018[s]	16.3
Dizziness	7(30.4%)	2(8.3%)	3(12.5%)	0.015[s]	0.153	0.019[s]	17.4
Shivering	6(26.1%)	1(4.2%)	4(16.7%)	0.006[s]	0.026[s]	0.023[s]	16.7

Values are expressed in absolute numbers, within parenthesis percentage (%) over column in total.

Discussion

This study was undertaken to evaluate the effectiveness of the dexamethasone versus clonidine as an adjuvant with bupivacaine for ultrasound guided SBPB block in patients underwent upper limb elective surgery in department of Anaesthesia, Pain, Palliative and Intensive care in Dhaka Medical College and Hospital. During this study period the selected patients were randomly divided into three groups (25 patients each) depending upon the study drug administered.

In this study, there had no statistically significant difference in characteristics regarding age, gender, height and weight in between group A received normal saline, group B received dexamethasone and group C received clonidine as an adjuvant to bupivacaine. Majority patients belongs to ASA I & rest in ASA II, in group A 11(44%), group B 13(52%) & in group C 14 (56%). Duration of surgery in group A (93.8±12.5) minutes, group B (97.6±14.7) minutes and group C (96.1±12.8) minutes without any statistically significant difference ($p > 0.05$). In group A, 2 patients (8%), group B, 1 patient (4%) and group C, 1 patient (4%) had block failure without any significant difference ($p > 0.05$).

A study had an overall success rate of 77.4% with highest being the clonidine group (90%) and minimum in dexamethasone group (60%) while in lignocaine group it was 84.6%17. The success with SBPB is reported to vary from 40% to 100% in different studies which is explained by different definitions of a successful block, landmarks and variable direction of needle insertion. SBPB with double stimulation technique has resulted in satisfactory success rate and is well tolerated[18].

In this study, haemodynamic parameters like HR, SBP, DBP and MAP were stable throughout the perioperative periods and did not show any significant fluctuations ($p > 0.05$). Hoq and Maruf (2018)[19] had also observed that vital parameters like pulse rate, blood pressure, respiratory rate and arterial oxygen saturation values were similar in both the groups and did not show any significant fluctuation; which also supports our study result. These findings of our study also correlated with the study by Rustagi et al. (2016) demonstrated that drop-in pulse rate and blood pressure was statistically significant in clonidine group, it was not clinically significant as none of their patients had bradycardia or hypotension nor did they have any hemodynamic instability[20]. But it lays caution that clonidine does reduce the pulse rate and blood pressure and care should be taken for patient where decrease in pulse rate and blood pressure could be detrimental.

During pre and postoperative period, regarding VAS score, there was no significant difference found in between three groups except at 15 min interval. But postoperative VAS score was significantly low in group B and group C in comparison to group A at 6th hours ($p = 0.002, 0.006$) at 14th hours ($p = 0.018, 0.015$) and 20th hours ($p = 0.022, 0.025$) respectively. At all other time interval, no significant results found. In comparison to group B, VAS score was significantly lower at 12th, 16th and 18th hours in group C ($p = 0.016, 0.018$ and 0.014) respectively.

Singh S and his colleagues reported that the VAS score was started rising in control group while remaining low in the clonidine group. Because the VAS score was significantly less from 5 to 30 min (P-value at 5 min 0.043, at 10 min 0.008 and at 30 min 0.007), they concluded that onset with clonidine was faster. Again, after 240 min, the VAS was significantly lower and thus they also concluded that the action was prolonged[21].

In this study, during preoperative period regarding RSS score, in comparison to group A, significant difference found from 30 min to 120 min time interval in group C ($p < 0.05$), and no significant difference found in group B. On the other hand, significant difference found in group C from 30 min to 120 min time interval in comparison to group B ($p < 0.05$).

The RSS was high in group C in first eight hours during postoperative periods than two others groups which was also statistically significant as $p < 0.05$, that means patients had received clonidine with bupivacaine in SBPB, was more sedated than two others groups. In comparison to group A, significant result found in group B at 6th, 14th, 16th and 20th hours ($p < 0.05$). In comparison group C except 14th, 20th, 22th and 24th hours at all-time interval significant results found in comparison to group A ($p < 0.05$). In comparison between group B and C except 14th, 20th, 22nd and 24th hours significant results found at all-time intervals in group C ($p < 0.05$).

Rambabu et al. (2018)[7] observed that clonidine induced greater sedation in the patients during the early part of their stay in postanesthesia care unit. These findings support to this study. Hari et al. (2015) observed that intraoperative sedation scores were higher in the clonidine group when compared with the control group but were not statistically significant[22]. The highest score in the clonidine group had a sedation score of 3, and no patient had a sedation score of 5 or more which required airway maintenance.

In the present study, the time for the onset of sensory block and the onset of motor block was lower in group C than that of group A and group B which was statistically insignificant ($p > 0.05$). Considering the time for complete sensory block which was lowest in group C (14.7±3.0 min) than that of group A (23.6±3.1 min) and group B (18.9±3.2 min) (p values were 0.038 vs 0.033 vs 0.025). The time for the onset of maximum motor level was also less in group C (20.8±2.4 min) than that of group A (29.5±3.9 min) and group B (23.5±3.1 min) which was also statistically significant (p values were 0.021 vs 0.038 vs 0.006).

Hari et al. (2015)[22] observed that the mean onset of sensory block was 17.50±2.86 minutes, 17.17±3.13 minutes and 18.33±3.55 minutes in dexamethasone group, clonidine group and control group respectively. Whereas, the mean onset of motor block was 31.0±4.8 minutes, 30.33±4.14 minutes and 31.0±5.48 minutes in dexamethasone group, clonidine group and control group respectively; which also supports our study results. These findings of our study correlated with the study by Rambabu et al. (2018) concluded that mean duration of the onset of sensory blockade with clonidine was 9.20±4.23 minutes[7]. Mean duration of the onset of sensory blockade with dexamethasone was 8.57±4.01minutes. The difference in the duration of the onset of sensory blockage in both the groups was statistically not significant as p value 0.55. Same study observed that mean duration of the onset of motor blockade with Clonidine was 12.20±4.23 minutes. Mean duration of motor blockade with Dexamethasone was 11.57±4.01 minutes[7].

In this study, the time to regression of sensory block (242.1±16.57 vs 932.9±44.9 vs 739.16 ±13.47 min) between three groups (p value was 0.001 vs 0.001 vs 0.001) and time to regression of motor block (175.6±17.5 vs 780.8±26.2 vs 570.6 ±22.0 min) was longer in group B than that of group A and group C (p values were 0.001 vs 0.013 vs 0.002). Considering the time for Motor recovery (190.8±18.3 vs 810.6±25.8 vs 600.6 ±24.9 min) was also prolonged in case of group B than two other groups (p values were 0.0004 vs 0.0010 vs 0.003). Shah et al. (2015) concluded that the duration of sensory and motor block was significantly more in Dexamethasone group as compared with Clonidine group (P1 sensory = 0.047, P1 motor = 0.031)[23].

In present study, when considering the time of first demand of analgesia (minute) between three groups, it was longer in group B (975.2±29.0min) than group A (260.6±23.0) and group C (760.8 ±25.5min) (p

values were 0.0006 vs 0.010 vs 0.001). Another study found the time to first analgesic requirement was significantly more in Clonidine group and Dexamethasone as compared with control group (P1= 0.006, P2= 0.016). These findings also correlate this study[23]. Hari et al. (2015) had observed that the mean duration of analgesia was 11.49±1.66 hours, 19.41±2.60 hours and 7.56±1.65 hours in clonidine group, dexamethasone group, and control group respectively[22].

In this study, total opioid Requirement in 1st 24 hours (mg) was more in group A (232.8±15.5 4mg) than that of group B (84.7±13.8mg) and group C (166.1±19.4mg) that showed the patients were receiving dexamethasone with bupivacaine in SBPB had lowest opioid requirement in 1st 24 hours (p values were 0.001 vs 0.006 vs 0.004).

Tandoc and colleagues evaluated 90 patients undergoing shoulder surgery using interscalene block with 0.5% bupivacaine (40 ml) and divided them into 3 groups: control patients, with no additive, and two dexamethasone groups, to whom 4 mg and 8 mg dexamethasone were added[24]. The duration of analgesia was significantly prolonged in both dexamethasone groups (21.6 h and 25.2 h, respectively) compared with the control group (13.3 h). Postoperative analgesic consumption for the first 48 h was significantly lower in both dexamethasone groups compared to the control group[24].

Singh & Aggarwal (2010) suggests that clonidine 0.150 mg in 40 ml of 0.25% bupivacaine significantly enhances the quality of supraclavicular brachial plexus block in upper limb surgeries by a faster onset and prolonged duration of sensory and motor block, enhancing post-operative analgesia and decreased postoperative opioid requirement in first 24 hours[21].
In another study, it was found that there was no difference in 24 hours morphine requirement, postoperative NRS scores, satisfaction scores when compared dexamethasone and clonidine as an adjuvant to 1.5% lignocaine with adrenaline in infra-clavicular brachial plexus block for upper limb surgeries[23]. It was probably due to different pharmacological preparation and use of conventional methods. Total antiemetic requirement in 1st 24 hours significantly lower in group B and group C in comparison to control group A.($p < 0.05$)

In this study, adverse effects like nausea (17.4%), dizziness (30.4%) and shivering (26.1%) were higher in group A than group B and group C. In group C hypotension (20.8%) and bradycardia (16.7%) was more than group A and group B. All over perioperative adverse effects were less in group B than any others group which was statistically significant as $p < 0.05$.

Hari et al. (2015) had observed that two patients who received clonidine, the heart rate dropped below 50 beats per minute and they were give inj. Atropine 0.6 mg intravenously[22]. There were no such episodes later in these patients. No complications were noted in the dexamethasone and saline groups in the perioperative period. There were also no block related complications.

A Study reported that higher doses of clonidine had increased the incidence of hypotension. This also reported that used up to 150 μg of clonidine without significant hemodynamic changes[25]. But, in this study we used 100 μg of clonidine to reduce the frequency of adverse effects.

There was no incidence of complications such as Horner's syndrome, Chest discomfort; Phrenic and Recurrent Laryngeal nerve block; Subclavian vessel puncture and Pneumothorax in both groups in our study. These findings also correlate with Alfred et al. (2018)[26] who reported no vascular punctures nerve injury, pneumothorax, and local anesthetic toxicity in any of the groups. While Veeresham et al. (2015)[27] reported that incidence of vessel puncture/ hematoma was 16.67% in conventional technique group compared to nil in USG group which was significant with a p= 0.037. Incidence of nerve injury was 3.33% in conventional technique group compared to nil in groups US. Incidence of pneumothorax was nil in both groups.

So, in this study, the effect of addition of dexamethasone or clonidine to bupivacaine in SBPB was assessed and compared. Dexamethasone proves to be a better adjuvant than clonidine in view of duration of post-operative analgesia (greater time of 1st demand of analgesic administered), lesser opioid consumption in 1st 24 hours, longer duration of sensory and motor block and lesser adverse effects.

Conclusion

Dexamethasone more effective than clonidine as an adjuvant with bupivacaine for ultrasound guided supraclavicular brachial plexus block in aspect of reduced overall adverse effects, total opioid requirements, were able to prolong analgesia and motor block.

Declaration

Ethics approval

The study was approved by approved by the Ethical Review Committee, DMCH (Memo No. ERC-DMC/ECC/2021/237).

Author Contributions:

Conception and development of the idea: MIA
Writing: MIA, MRA
Data analysis: MRA, MSA, RA
Data collection: MMH, RMR, AKMNK, MSA
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