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Reconfiguring the Scope of Supraclavicular Brachial Plexus block with Bupivacaine along with the Adjuvants Dexmedetomidine, Clonidine or Fentanyl during the COVID-19 Pandemic: A Comparative, Double Blinded Study

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Abstract: ***Introduction: In COVID- 19, preference of regional anaesthesia e.g., Supraclavicular brachial plexus was given over general anesthesia for upper limb surgeries. A search for an ideal adjuvant with bupivacaine and dexamethasone, ketamine has not yet been studied till now. Aim: To compare and evaluate the effects of Dexmedetomidine, Clonidine or Fentanyl as an adjuvant to Bupivacaine in USG guided Supraclavicular plexus block for the Upper limb surgeries. Materials and Method: A comparative, double-blind study. 90 cases of 18-65yrs, ASA grade I-II, were grouped into BD, BC, BF (30 each). Each group received 0.5% bupivacaine 20ml, inj Lignocaine (2%) with adr. 10ml, Inj Dexamethasone 4mg, inj Ketamine 30mg. 1mcg/kg dose of dexmedetomidine, clonidine and fentanyl. Total volume 35ml. Results: Age, weight, height, ASA, sex, SBP, DBP & HR were similar. Onset of sensory/motor block was earliest in BD than BC, and longest in BF. The duration of sensory/motor block and analgesia was longest in BD and shortest in BF.VAS Score was least in BD. and highest in BF. Conclusion: We conclude that dexmedetomidine provides a better edge due to fast onset, prolonged duration of sensory-motor blockade, better and longer pain relief with ability to achieve sedation without hemodynamic effects.***

Keywords: Supraclavicular, bupivacaine, dexmedetomidine, clonidine, fentanyl

1. Introduction

Coronavirus disease, a global pandemic, was named by WHO as COVID- 19.[1] This virus was highly contagious[2,3] and had multi-systemic involvement like respiratory, cardiac, neurological system. Anesthesiologists had 6.6 times more risk of viral load transmission, as they performed aerosol generating procedures[4-6] like endotracheal intubation[7], bag mask ventilation, airway manipulation[8], jet ventilation, extubation[9] etc. Procedures in regional anesthesia (RA)[10-15] e.g. Peripheral nerve blocks (PNB), central neuraxial procedures or procedures performed under local anesthesia (LA) carried low risk of viral transmission.

RA could also provide better and prolonged analgesia-anesthesia than GA in both intra- and post-operative periods.[16-17] RA lessens our dependency on different pharmacological analgesic agents to control pain, such as opioids, anti-inflammatory etc and thus reduces opioid consumption.[18] With RA we can also avoid the complications associated with GA like sore throat, barotrauma, teeth injury, residual paralysis, aspiration etc.[19-22] We can achieve early mobilisation- early discharge, thus, posing less financial burden on the patient.[23]

In literature of RA and Covid-19, evidences suggested RA techniques to be safe with no cases of symptoms worsening or treatment drug interactions were reported.[24-26]Thus, the reliance on RA and LA was an imperative alternative in Covid-19 patients. [27-29]

Supraclavicular brachial plexus block, "Spinal of the arm" [30] provides a complete surgical anesthesia in the upper limb below the shoulder area. [31-32] Nowadays we see revolution in anesthesia with the use of ultrasonography (USG) and newer adjuvants.[33]

USG provides various advantages over blind landmark technique, in proper visualization of anatomical structures, needle alignment and LA drug distribution. Thus, we achieve high success rate, improved procedural safety with less vascular-pleural damage and less neuronal injury (0.04%). [34-37]

LA agents like bupivacaine, lignocaine were used in PNB but they had short analgesic duration, which wear off and expose patient to surgical pain.

Addition of adjuvant to LA agents decreases the conversion of PNB to GA.[38] They potentiate LA properties, thus reduces LA dose, achieves early onset of anesthesia and prolongs the analgesic duration both intra- and post-operative, thus reducing the demand of other systemic analgesic drugs.[39-41]

No technique and drug are without its complications, same hold true for adjuvants.

Opioids have side effects like nausea, vomiting, drowsiness, pruritus, respiratory depression, hypotension etc. [42-43]

2. Literature Survey

The search for an ideal additive continues. To avoid opioids has led us to try the centrally acting α2(alpha 2) adrenergic agent, clonidine and dexmedetomidine. They are known for their sedative, analgesic, antiemetic actions[44-45] and antihypertensive properties.[46]

Dexmedetomidine, a highly selective α-2 agonist with an $\alpha 2 : \alpha 1$ ratio of 1620 : 1 [47-48] and 8 times more selective for α2 receptors than clonidine.[49] It gained popularity due to its improved and short-lived side effects profile than clonidine. Dexmedetomidine if not titrated or not used as an intravenous infusion, it may cause severe bradycardia and hypotension. [52] Whereas, Clonidine is associated with bradycardia, hypotension, rebound hypertension, which can last up to 8 hours after administration.[50-51]

Dexamethasone, a highly selective long-acting glucocorticoid ($t_{1/2}$ >36 h) has been used as an adjuvant in PNB.[53-55]It has potent analgesic effects. [56] It inhibits nociceptive C fibers[57-58] and decreases the LA absorption by vasoconstriction.[59] Thus, along with LA, it influences the onset and duration of analgesia. [53-55]

The only thing unusual about the block was the use of steroid (Dexamethasone) and NMDA antagonist (Ketamine) with the adjuvant-bupivacaine mixture, this combination is not found in the literature available on supraclavicular plexus block till far.
With this background we have carried out such study to compare the anaesthetic quality with the addition of either Dexmedetomidine, Clonidine or Fentanyl to 0.5% bupivacaine in supraclavicular brachial plexus block for the upper limb surgeries.The primary objective was to study the efficacy of these 3 adjuvants in terms of onset, duration of the sensory/motor block and duration of analgesia (time of first rescue analgesia). The secondary objective was to compare these adjuvants on the basis of hemodynamic parameters, pain scores and to monitor for any side-effects, which may occur and treat them immediately.

3. Methods

Study design: This is a comparative, double-blinded study. All patients included were allocated as per Convenient sampling, no randomisation was possible (scarcity of drugs in Covid lockdown) into three groups.

Study place: Orthopaedic Operation Theatre and Orthopaedic ward of a peripheral tertiary care centre, Nalbari, Assam.

Study period: The period of our study was 1 year, during the 2nd wave of Covid-19 pandemic, Feb.2021-Feb. 2022.

Ethical approval: Enrolment of the patients was initiated only after achieving the approval by the Ethics committee of the institution.

Patient selection: Written informed consent was obtained from patients undergoing elective or emergency upper limb surgery including arm, forearm, and hand fractures, with American Society of Anesthesiologist (ASA) I and II; of both sexes; and age range from 18–65 years.

Patients with a history ofupper limb neuropathy or local infection, ASA III-IV, elective cases with active Covid positive status (these were done post 4 weeks) were excluded from the study. Also, patients with Severe respiratory distress, allergy to local anesthetic drugs were excluded.

Sample size Among 110 patients initially enrolled in the study, 20 patients had to be excluded because of the applied exclusion criteria, 90 patients were divided equally into three groups receiving dexmedetomidine, fentanyl, and clonidine, respectively, to a mixture of bupivacaine in the supraclavicular brachial plexus block.
Patients were categorised into the following groups: Group BC, Group BD and Group BF, each group had 30 patients each.

Group BC: Patients received of 0.5% isobaric bupivacaine 20ml, inj Lignocaine (2%) with adrenaline (1:200000) 10ml, Inj Dexamethasone 4mg, inj Ketamine 30mg + Clonidine 1mcg/kg.

Group BD: Patients received of 0.5% isobaric bupivacaine 20ml, inj Lignocaine (2%) with adrenaline (1:200000) 10ml, Inj Dexamethasone 4mg, inj Ketamine 30mg + Dexmedetomidine 1 mcg/kg.

Group BF: Patients received of 0.5% isobaric bupivacaine 20ml, inj Lignocaine (2%) with adrenaline (1:200000) 10ml, Inj Dexamethasone 4mg, inj Ketamine 30mg + Fentanyl 1mcg/kg.Total volume of LA mixture was made 35ml, to avoid biasing.

All investigators, staff, and patients were blinded to the treatment groups. Patients' assessment and observation were recorded by a second blinded researcher both in the operating theatre and recovery room. The three solutions of the studied drugs were prepared by a staff member who was not involved in the study.

4. Procedure

All measures of covid-19 to prevent further spread to health workers and other patients were taken during the entire intra-operative, as well as post-operative period.

The patients were taken to operation theatre, all the basic monitoring (heart rate HR, non-invasive blood pressure NIBP, five-lead electrocardiography ECG, and pulse oximetry SPO2 probe) were connected, and baseline vital readings were recorded before performing the block. 18 G iv cannula was taken in the opposite non-operating limb and intravenous Lactated Ringer's solution infusion8 ml/kg was

started. Every patient was made to wear surgical mask and oxygen mask was put above it, to avoid aerosol spread. Oxygen was supplied at a low flow intra-operatively.

5. Technique

Supraclavicular brachial plexus block byUSG technique using Mindray M7 Portable ultrasound machine with linear probe 3–14 MHz probe. Patient was kept supine with head rotated 45° to the opposite side with ipsilateral arm adducted. The USG probe was placed in the supraclavicular fossa in the neck, above the clavicle, we aimed to locate the subclavian artery (the pulsatile hypoechoic structure on top of the hyperechoic first rib). Just lateral-posterior to the artery is the plexus, and beneath we can see the sliding lung. The plexus was identified as cluster of hypoechoic nodules, like brunch of grapes or honeycombed appearances placed on the first rib, arranged as upper, middle, and lower trunk, or further divisions can also be seen. We inserted 5cm long short bevel stimuplex nerve stimulator needle, 1cm lateral and in plane to the USG probe. Creation of pocket was done by injecting LA close to artery above the rib and subsequent LA injections were given at 3 sites i.e. in the lower, middle, and upper pole of artery. Incremental injection with negative aspiration for blood or air were done. We could see the dispersion of plexus in USG, indicating the spread of LA. Time of injectionof LA was noted.

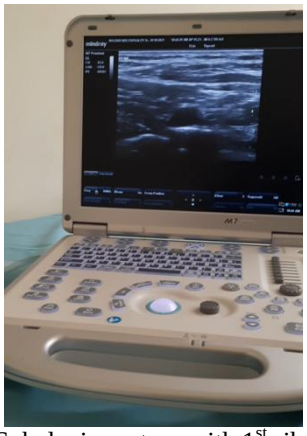

Figure 1: Subclavian artery with 1st rib and pleura

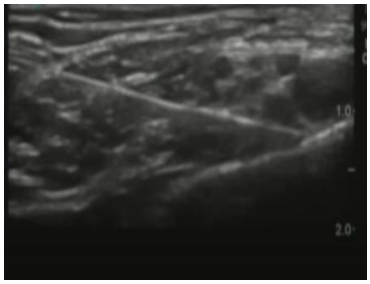

Figure 2: Needle aiming for pocket creation

Intra-operative parameters included assessment of the sensory, motor, sedation, hemodynamic parameters, and side effects.

Assessment of sensory block: was done by pinprick at each minute after LA injection in corresponding dermatomal areas of radial nerve, ulnar nerve, median nerve, and musculocutaneous nerve till the time grade 2 was achieved. Grade 0: Sharp pin felt, normal sensation, no pain relief. Grade 1: Analgesia, mild pain felt, decreased sensation.Grade 2: Anaesthesia, no pain felt, complete loss of sensation.

Sensory onset was the time interval between injection of LA to abolition of pinprick response. The time interval from the end of LA administration to pain to pin-prick by patient was defined as the "duration of sensory block."**Duration of analgesia** was measured as the duration between drug administration to giving first rescue analgesia.

Motor block was assessed by using a modified Bromage scale on a 3-point scale:Grade 0: Normal motor function with full flexion and extension of elbow, wrist, and fingers. Grade 1: Decreased motor strength with ability to move the fingers only. Grade 2: Complete motor block with inability to move the fingers.Assessment of the motor block was performed by the same observer at each minute until complete motor blockade after drug injection.

Motor onset was defined as thetime of injection of a drug to development of motor weakness in the hand and finger, i.e., not able to lift/raise hand and not able to move fingers. **Duration of motor block** was thetime interval from the onset to the recovery of complete motor function.

Intra-operative monitoring of vital parameters as HR, NIBP & SPO2 were performed every 5 min for the first 15 min and thereafter every 15 min till the end of surgery. We have taken the mean of all these measurements during the OT, and have compared them statistically among the three groups.

Modified Ramsay Sedation scale was used to assess the sedation level. It was measured 20 mins after starting the surgery and post-operatively before shifting the patient to orthopaedic ward for each patient using a 4-point scale as follows: grade 1 awake, grade 2 drowsy but responds to verbal command (mild sedation), grade 3drowsy but responsive to light glabellar tap or loud auditory stimulus (moderate sedation), and grade 4 unresponsive to light glabellar tap or loud auditory stimulus (deep sedation).

VAS score (visual analogue scale) (0-no pain ; 10-maximum pain) was explained to all patients in their preoperative visit. VAS Score was measured after achieving the peak of sensory level, post-operatively before shifting the patient to ward and at 6 hours and at the time of pain perception by the patient. Inj. Paracetamol 1g/kg intravenously was given as rescue analgesia at VAS ≥4 or whenever patient demanded for it. When VAS ≥6, inj. Diclofenac 75mg iv was administered.

Adverse effects were also noted: hypotension (i.e., 30% decrease in mean blood pressure relative to baseline Or SBP <90mm Hg) which was treated with intravenous increments of inj. Mephentermine 3 mg iv till normal blood pressure was regained, bradycardia (20% decreaseHR or < 60 beats per min) which was treated by intravenous atropine 0.6 mg, and nausea, vomiting, respiratory depression and technical side effects like hematoma, pneumothorax, sparing of nerve roots were all recorded.

Rescue/Alternative plan: sparing of ≥2 nerves after 30 mins of LA injection, then it was considered as a failed block, and, if sparing of 1 nerve was observed theninj. Fentanyl 50 mcg iv with inj. Midazolam 1 mg iv were given. Even after supplementation, if the pain persist it was treated as a failed block and GA was administered by placing supraglottic device, I-Gel or second order Supraglottic device.

Statistics: All data were recorded on data sheet, after collection, data were checked meticulously and then compiled, analysed for statistical significance.Statistical presentation and analysis of the present study were conducted, using SPSS software version 24.0 (IBM Corporation, Armonk, NY, USA) statistics. Quantitative variables were presented as mean ± standard deviation and were analyzed by one-way ANOVA test. Significant ANOVA test was further analyzed by *post hoc* test to determine the significant group. Qualitative variables were presented as numbers and percentages and were analyzed by Chi-square test. $P < 0.05$ was considered significant and while at 0.01 and 0.001 are highly significant.

6. Results

Among 110 patients initially enrolled in the study, 20 patients had to be excluded because of the applied exclusion criteria (fig.1), 90 patients were divided equally into three groups with 30 patients each receiving clonidine, dexmedetomidine, and fentanyl, Group BC, BD, BF respectively, to a mixture of bupivacaine in the supraclavicular brachial plexus block.

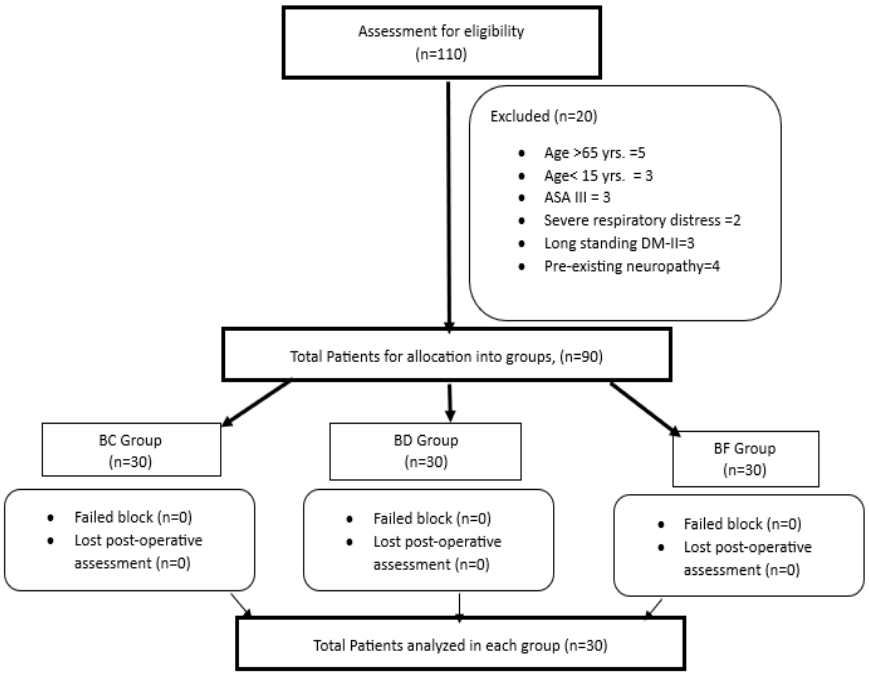

Figure 1: Consort flow diagram showing no. of patients at each phase of the study

In present study, the patients in each group were demographically comparable regarding age, weight, height, ASA grading, sex, duration of surgery and found statistically insignificant (P<0.05), table 1.

Table 1: Demographic profile of patients

Parameters	Group BC	Group BD	Group BF	P value
Age (yr.)	26.3 ±3.7	24.5 ±3.72	25.3 ±3.45	0.164
Weight (kg)	56.63 ±5.4	55.53 ±4.1	56.26 ±3.6	0.597
Height (cm)	163.83±8.7	161.53 ±4.0	160.71 ±4.5	0.129
ASA I	18 (60%)	17(56.6%)	16(53.3%)	0.873
ASA II	12 (40%)	13(43.3%)	14(46.6%)	
Female no.	16 (53.3%)	14 (46.6%)	13(43.3%)	0.732
Male no.	14 (46.6%)	16 (53.3%)	17 (56.6%)	
Duration of surgery (min)	174.27±13.1	172.81±14.8	169.21±13.5	0.456

Hemodynamic data of the study population: There were no significant differences between the groups in hemodynamic data, SBP, DBP & HR, table 2.

Table 2: Distribution according to hemodynamic data

Parameter	Group BC	Group BD	Group BF	P value
HR (beats/min)	77.06 ±3.9	75.5 ±3.8	74.6 ±4.5	0.670
SBP (mm Hg)	120.06±7.4	118.4±9.8	120.86±7.1	0.498
DBP (mm Hg)	72.16±6.8	73.93±9.3	72.16±4.8	0.555

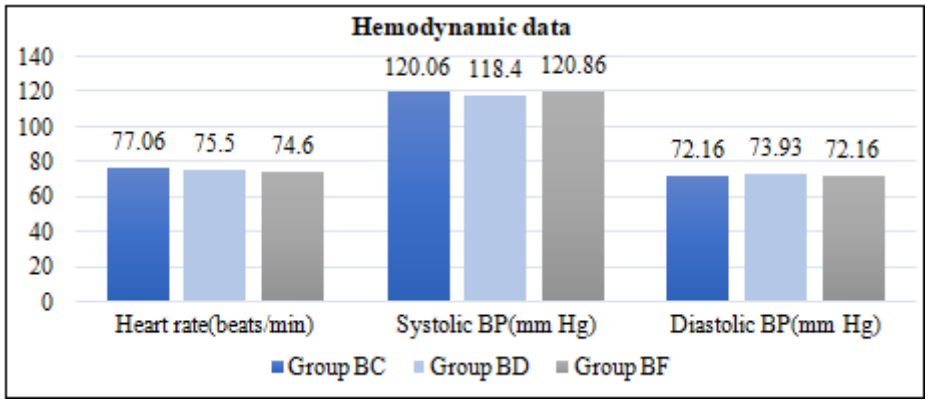

Figure 2: Hemodynamic data

Onset of sensory and motor blockade: The mean onset of sensory block was earliest in BD (7.7±1.96 min) followed by BC (6.6±1.65 min), and longest in BF (9.1±1.85 min). Similar result was seen with mean onset of motor blockade, faster in BD>BC>BF with 8.9±1.87 min, 9.8±1.71 min and 11.8±1.85 min respectively. The difference between the 3 groups was found to be statistically and clinically significant (P < 0.001), table 3.

Table 3: Onset of sensory and motor blockade

Parameters	Group BC		Group BD		Group BF		p-value
	Mean	± SD	Mean	± SD	Mean	± SD	
Onset of sensory Blockade (min.)	7.7	1.96	6.6	1.65	9.1	1.85	<0 .00001 (Very significant)
Onset of motor Blockade onset (min.)	9.8	1.71	8.9	1.87	11.8	1.85	<0 .00001 (Very significant)

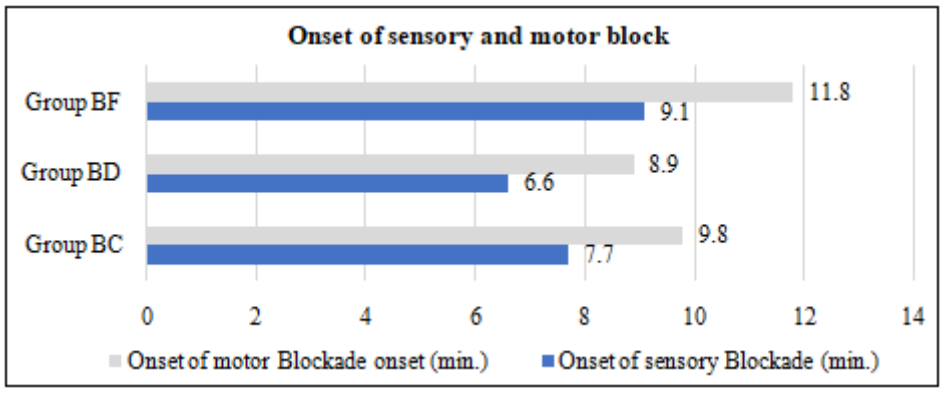

Figure 3: Onset of sensory & motor block

Duration of sensory and motor block was prolonged in **BD> BC>BF** group. The mean duration of sensory block in BD was 816.3±42.6 min, BC was 647.5±41. min and 422.6±23.3 min in BF group. Whereas, the mean duration of motor blockade was 728.8±43.2 min, 584.7±34.7 min and 405.7±24.4 min respectively in BD, BC, and BF group. The difference between the 3 groups was found to be statistically and clinically significant (P < 0.001), table 4.

Table 4: Duration of sensory and motor blockade.

Parameters	Group BC		Group BD		Group BF		p-value
	Mean	± SD	Mean	± SD	Mean	± SD	
Duration of sensory blockade (min.)	647.5	41.7	816.3	42.6	422.6	23.3	<0 .00001 (Very significant)
Duration of motor blockade (min.)	584.7	34.7	728.8	43.2	405.7	24.4	<0 .00001 (Very significant)

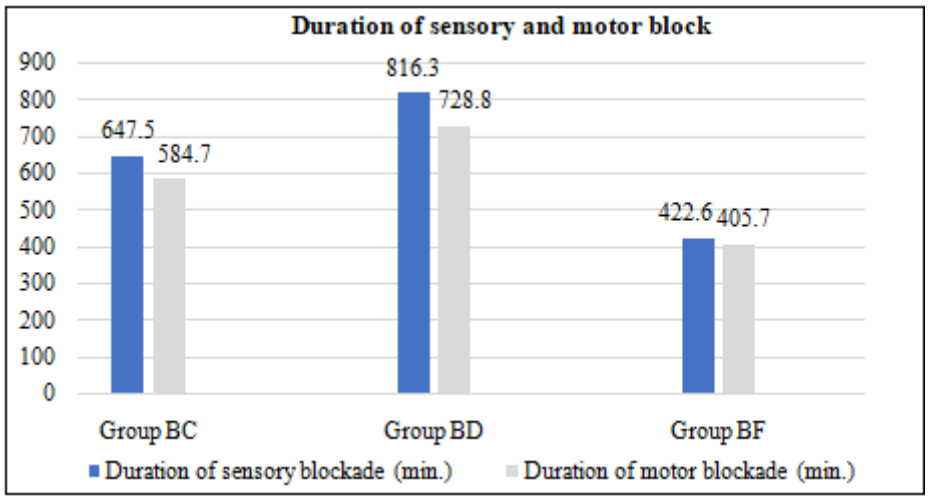

Figure 4: Duration of adjuvants

Time of 1st rescue analgesia/ duration of analgesia:There was a very significant increase in the duration of analgesia (time of 1st rescue analgesia) in BD group (822±35.4 min) compared to BC group(658.8±40.9 min) and BF group (432.5±38.2 min),p=<0 .00001, table 5.

Table 5: Time of 1st rescue analgesia (min) in three different groups

Parameters	Group BC		Group BD		Group BF		p-value
	Mean	± SD	Mean	± SD	Mean	± SD	
Time of 1st rescue analgesia (min.)	658.8	40.9	822	35.4	432.5	38.2	<0 .00001 (Very significant)

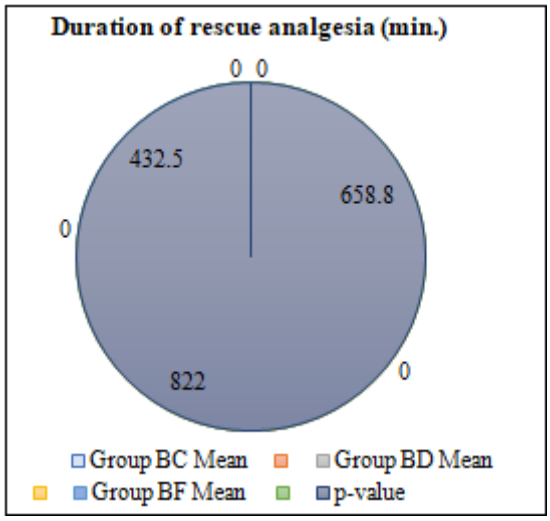

Figure 5: Duration of rescue analgesia.

VAS Score: By the results obtained, best analgesia was obtained by dexmedetomidine drug, then clonidine. Patients of fentanyl group showed highest VAS Score. The difference between the 3 groups was found to be statistically and clinically significant (P < 0.001), table 6.

Table 6: VAS score in three different groups

Pain score (VAS Score)	Group BC(N=30)	Group BD(N=30)	Group BF (N=30)	P value
	Mean	Mean	Mean	
After supraclavicular brachial plexus block	0	0	0	0
At end of surgery	0	0	0	
6 hr post-surgery	0	0	0	
At time of 1st rescue analgesic dose.	3.967	2.967	4.133	0.0009 (Very significant)

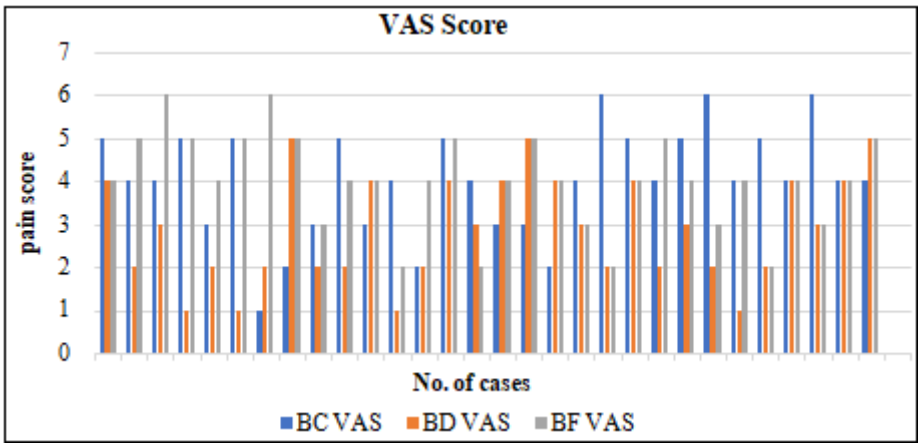

Figure 6: VAS Score.

Perioperative complications in all Groups were compared, results as per table 7.

Table 7: Perioperative complications in all Groups

Complications	Group BC		Group BD		Group BF		P value
	N=30	%	N=30	%	N=30	%	
Nausea	0	0	0	0	0	0	0
Vomiting	0	0	0	0	0	0	
Pruritus	0	0	0	0	0	0	
Hypotension (↓BP 30% or SBP <90mmHg)	1	3%	1	3%	0	0	0.608
Bradycardia (↓HR 20% or <50bpm)	0	0	2	6%	0	0	0.132
Pneumothorax	0	0	0	0	0	0	0
Vascular puncture/Hematoma	0	0	0	0	0	0	
Horner's syndrome	0	0	0	0	0	0	
Phrenic nerve block	0	0	0	0	0	0	
Sedation (Ramsay ≥3)	1	3%	2	6%	0	0	0.363
Sparing of 1 nerve	1	3%	0	0	2	6%	0.363
Respiratory depression	0	0	0	0	0	0	0
Failure of block	0	0	0	0	0	0	

7. Discussion

Adjuvants show synergistic action with bupivacaine, but they differ in their mechanism of action, which may influence their onset and duration of anesthesia. α2 drugs act on the A delta-C fibres (peripheral level), on the dorsal horn of spinal cord (central level) by hyperpolarising the nerve membrane potential and inhibiting sub-P release.[60-62] Whereas, Fentanyl act at every level of pain pathway but mainly at the central level, it also shows peripheral distribution to the systemic circulation.[63]

In our study we found promising results (p<0.0001) of early onset, prolonged duration of sensory/motor blockade and longer rescue analgesic with dexmedetomidine than fentanyl .Our findings correlated with Swaro et al.,[64] Patra et al.[65]

Similar results (p<0.0001) were obtained when dexmedetomidine was compared with clonidine. Our results are supported by studies of S. Swami et al.,[66] More P et al.,[67] Tripathi et al.,[68]where dexmedetomidine showed better edge in onset and duration of sensory/motor block over clonidine. Dexmedetomidine also enhances the duration of analgesia than clonidine.

Similar to our result, Abdallah et al.[69] in a meta-analysis compared dexmedetomidine and clonidine with bupivacaine either intrathecally or perineurally, the results proved that dexmedetomidine shows more prolongation of the sensory/motor block and, also, prolongs the postoperative analgesia duration.

Vandana et al.,[70] Ahmed N et al. [71] studies supports our finding that clonidine show faster onset, long duration of sensory/motor blockade and longer rescue analgesic duration than fentanyl. These results were statistically very significant (p value <0.0001).

Naveen et al.,[72] compared these same 3 adjuvants with ropivacaine in supraclavicular block but. The results suggested that both α2 agonists has faster onset of sensory/motor blockade, with longer sensory blockade as compared to fentanyl. Whereas, Dexmedetomidine shows shorter onset of sensory/motor blockade than clonidine.

Time to first rescue analgesia (duration of analgesia) : we found significant finding (p <0.001) that fentanyl had early weaning of sensory block and maximum pain free period was obtained by dexmedetomidine. Similar results were obtained by Swami et al.,[66] More et al.,[67] Vandana et al.,[70]Naveen et al.[72]

In our study, in all 3 groups we found long duration of sensory block than motor block, this can be supported by de Jong and Wagman study.[73] This can be explained by the arrangement of nerve fibers in the muscle bundle and by the

concentration of LA drug required to anesthetise that nerve fibre. Sensory nerve fibers are easy to block, as they are small in size and needs less LA concentration than motor nerve fiber. Hence, sensory block is prolonged than the motor block and pain is felt after the return of motor function.

Current study shows that all 3 adjuvants were better in providing post-operative analgesia, and **mean VAS Score** was zero in all 3 groups till 6 hrs. Overall value of mean VAS Score was statistically significantly (p=0.0009) more in fentanyl than clonidine than dexmedetomidine. This result is supported by Meena et al. [74]

As, we have added dexamethasone and ketamine to the adjuvants with LA drug, we found rapid onset of sensory/motor blockade, along with prolonged effect post-operatively. Findings of dexamethasone is supported by studies of Nagabhushanam et al.,[75] Pathak et al.,[76] Talukdar et al., [77] Shrestha et al. [78] and for ketamine we quote Hashim et al.,[79] Lashgarinia et al.,[80] Youssef et al. [81] studies.

Complications of supraclavicular brachial Plexus block such as hematoma, Horner's syndrome, phrenic nerve block, pneumothorax, respiratory depression were not seen in our study. No case of pruritis, nausea and vomiting were recorded.
Hypotension was seen in 1 case (3%) each of dexmedetomidine and clonidine. Bradycardia occurred in 2 cases (6%) of dexmedetomidine.

Sparing of 1 nerve was found in 1 case (3%) in clonidine and 2 cases (6%) of fentanyl, but no incidence of block failure necessitating induction of general anesthesia was seen.

Sedation score ≥ 3 was observed in 1 case (3%) receiving clonidine and 2 cases (6%) of dexmedetomidine, which resolved spontaneously with time without any interference on recession of block.

None of the cases reported LAST (local anesthetic systemic toxicity), neuropathy as complication and none of the complications showed statistical significance.

8. Summary

Dexmedetomidine, Clonidine and Fentanyl all can be used as an adjuvant with bupivacaine for better anaesthesia and analgesia peri-operatively without major side effects.

9. Conclusion

After analysing the results, we can conclude that dexmedetomidine has better edge in achievement of sedation without hemodynamic effects, fast onset, and prolonged effect of sensory and motor blockade. It also provides better post-operative analgesia, by prolonged duration of analgesia and longer time of first rescue analgesia.

We can also conclude that Ketamine and Dexamethasone can be combined with adjuvant, for enhancing the properties of local anesthetic in the brachial plexus block.

10. Limitations of Study

- No randomisation was possible, due to COVID-19 pandemic; thus, convenient sampling was opted.
- Individual effect of dexamethasone and ketamine cannot be predicted.

References

[1] World Health Organization. WHO Director-General's remarks at the media briefing on 2019-nCoV on 11 February 2020. Available from URL: https://www.who.int/dg/speeches/detail/ who-director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020 (accessed March 2020).
[2] van Doremalen N, Bushmaker T, Morris DH. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARSCoV-1. medRxiv 2020.
[3] Heinzerling A, Stuckey MJ, Scheuer T, Xu K, Perkins KM, Resseger H, Magill S et al. Trasnmission of COVID-19 to health care personnel during exposures to a hospitalized patient—Solano County, California, February 2020. Morbidity and Mortality Weekly Report. 2020 Apr 4;69(15):472.
[4] World Health Organization. Infection prevention and control of epidemic-and pandemic-prone acute respiratory diseases in health care. 2007. https://www.who.int/csr/resources/publications/WHO_CD_EPR_2007_6/en (accessed 25/04/2020).
[5] Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. PLoS One 2012; 7: e35797.
[6] Gupta A, Krishna B, Narayanan V, Kumar S, Gupta N, Malviya AK et al. A Cross-Sectional Study to Ascertain the Effect of COVID-19 Pandemic on Regional Anaesthesia Practices Amongst Anaesthesiologists of India. Cureus. 2022 Aug 21;14(8).
[7] Rowlands J, Yeager MP, Beach M. Video observation to map hand contact and bacterial transmission in operating rooms. Am J Infect Control 2014; 42: 698-701.
[8] Greenland JR, Michelow MD, Wang L, London MJ. COVID-19 infection: implications for perioperative and critical care physicians. Anesthesiology. 2020 Jun 1;132(6):1346-61.
[9] Nicas M, Nazaroff WW, Hubbard A. Toward understanding the risk of secondary airborne infection: emission of respirable pathogens. Journal of occupational and environmental hygiene. 2005 Mar 1;2(3):143-54.
[10] Uppal V, Sondekoppam RV, Landau R, El-Boghdadly K, Narouze S, Kalagara HK. Neuraxial anaesthesia and peripheral nerve blocks during the COVID-19 pandemic: a literature review and practice recommendations. Anaesthesia. 2020 Oct;75(10):1350-63.

[11] Hutton M, Brull R, Macfarlane AJ. Regional anaesthesia and outcomes. BJA education. 2018 Feb;18(2):52.
[12] Shelton CL, McBain SC, Mortimer F, White SM. A new role for anaesthetists in environmentally-sustainable healthcare. Anaesthesia. 2019 Sep;74(9):1091-4.
[13] Tan TK. How severe acute respiratory syndrome (SARS) affected the department of anaesthesia at Singapore General Hospital. Anaesthesia and intensive care. 2004 Jun;32(3):394-400.
[14] Rowlands J, Yeager MP, Beach M, Patel HM, Huysman BC, Loftus RW. Video observation to map hand contact and bacterial transmission in operating rooms. American Journal of Infection Control. 2014 Jul 1;42(7):698-701.
[15] Loftus RW, Koff MD, Birnbach DJ. The dynamics and implications of bacterial transmission events arising from the anesthesia work area. Anesth Analg 2015; 120: 853-60.
[16] Liu SS, Strodtbeck WM, Richman JM, Wu CL. A comparison of regional versus general anesthesia for ambulatory anesthesia: a meta-analysis of randomized controlled trials: Anesth Analg 2005; 101(6): 1634-1642.
[17] Swami SS, Ladi SD, Keniya VM, Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. Indian J Anaesth. 2012;56(3):243–9. doi:10.4103/0019-5049.98767.
[18] Hutton M, Brull R, Macfarlane AJ. Regional anaesthesia and outcomes. BJA Educ 2018; 2: 52-6.
[19] Saraswat V. Effects of anaesthesia techniques and drugs on pulmonary function. Indian J Anaesth 2015; 59: 557-64.
[20] Warren J, Sundaram K, Anis H, et al. Spinal anesthesia is associated with decreased complications after total knee and hip arthroplasty. Journal of the American Academy of Orthopaedic Surgeons 2020; 28: e213–e221.
[21] von Ungern-Sternberg BS, Boda K, Chambers NA, et al. Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. Lancet 2010; 376: 773–83.
[22] Chandni M, Soni CM, Parikh H. Comparison of the motor and sensory block by ropivacaine and bupivacaine in combination with lignocaine in supraclavicular block. Natl J Med Res. 2013;3(4):353–7.
[23] Chan VW, Peng PW, Kaszas Z, et al. A comparative study of general anesthesia, intravenous regional anesthesia, and axillary block for outpatient hand surgery: clinical outcome and cost analysis. Anesth Analg 2001;93:1181–4.
[24] Zhong Q, Liu YY, Luo Q, Zou YF, Jiang HX, Li H, Zhang JJ, Li Z, Yang X, Ma M, Tang LJ. Spinal anaesthesia for patients with coronavirus disease 2019 and possible transmission rates in anaesthetists: retrospective, single-centre, observational cohort study. British journal of anaesthesia. 2020 Jun 1;124(6):670-5.
[25] Yue L, Han L, Li Q, Zhong M, Wang J, Wan Z, Chu C, Zeng Y, Peng M, Yang L, Li N. Anaesthesia and infection control in cesarean section of pregnant women with coronavirus disease 2019 (COVID-19). MedRxiv. 2020 Mar 27:2020-03.
[26] Zhong Q, Liu YY, Luo Q, Zou YF, Jiang HX, Li H, Zhang JJ, Li Z, Yang X, Ma M, Tang LJ. Spinal anaesthesia for patients with coronavirus disease 2019 and possible transmission rates in anaesthetists: retrospective, single-centre, observational cohort study. British journal of anaesthesia. 2020 Jun 1;124(6):670-5.
[27] Warren J, Sundaram K, Anis H, Kamath AF, Mont MA, Higuera CA, Piuzzi NS. Spinal anesthesia is associated with decreased complications after total knee and hip arthroplasty. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2020 Mar 1;28(5):e213-21.
[28] von Ungern-Sternberg BS, Boda K, Chambers NA, Rebmann C, Johnson C, Sly PD, Habre W. Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. The Lancet. 2010 Sep 4;376(9743):773-83.
[29] Lie SA, Wong SW, Wong LT, Wong TG, Chong SY. Practical considerations for performing regional anesthesia: lessons learned from the COVID-19 pandemic. Canadian Journal of Anaesthesia. 2020;67(7):885.
[30] Butterworth JF, David MC, Wasnick JD. Clinical Anesthesiology. 5th ed. New York: McGraw-Hill Medical Publishing; 2013. p. 985–7
[31] Gray A. Ultrasound guidance for regional anesthesia. In: Miller RD, editor. Miller's Anesthesia. Philadelphia, Pa: Elsevier, Churchill Livingstone; 2010. p. 1675–86.
[32] Russon K, Pickworth T, Griffiths H. Upper limb blocks. Anaesthesia 2010; 65(1): 48-56.
[33] Marhofer P, Chan VWS. Ultrasound-guided regional anesthesia: current concepts and future trends. Anesth Analg. 2007;104(5):1265– 9.
[34] Mak PH, Irwin MG, Ooi CG, Chow BF. Incidence of diaphragmatic paralysis following supraclavicular brachial plexus block and its effect on pulmonary function. Anaesthesia. 2001;56(4):352–6.
[35] Brown DL, Cahill DR, Bridenbaugh LD. Supraclavicular nerve block: anatomic analysis of a method to prevent pneumothorax. Anesth Analg. 1993;76(3):530–4.
[36] Etezadi F, Karimi Yarandi K, Ahangary A, Shokri H, Imani F, Safari S, et al. The Effect of Needle Type, Duration of Surgery, and Position of the Patient on the Risk of Transient Neurologic Symptoms. Anesth Pain. 2013;2(4):154–8.
[37] Shankar H, Simhan S. Transient Neuronal Injury Followed by Intravascular Injection During an Ultrasound Guided Stellate Ganglion Block. Anesth Pain. 2012;2(3):134–7.
[38] Liu SS, Strodtbeck WM, Richman JM, Wu CL. A comparison of regional versus general anesthesia for ambulatory anesthesia: a meta-analysis of randomized controlled trials: Anesth Analg 2005; 101(6): 1634-1642.

[39] Chavan SG, Koshire AR, Panbude P. Effect of addition of fentanyl to local anesthetic in brachial plexus block on duration of analgesia. Anesth Essays Res. 2011;5:39–42. doi: 10.4103/0259-1162.84183.
[40] Nishikawa K, Kanaya N, Nakayama M, Iqarashi M, Tsunoda K, Namiki A. Fentanyl improves analgesia but prolongs the onset of axillary brachial plexus block by peripheral mechanism. Anesth Analg. 2000;91:384–7. doi: 10.1097/00000539-200008000-00028.
[41] Swain A, Nag DS, Sahu S, Samaddar DP. Adjuvants to local anesthetics: Current understanding and future trends. World J Clin Cases 2017; 5(8):307-323
[42] Wajima Z, Shitara T, Nakajima Y, et al. Comparison of continuous brachial plexus infusion of butorphanol, mepivacaine and mepivacaine-butorphanol mixtures for postoperative analgesia. Br J Anaesth. 1995;75(5):548-51.
[43] Jaffe JH, Martin WR. Opioid analgesics and antagonists. In: Gilman AG, Rall TW, Nies AS, Taylor P, eds. Goodman and Gilman's The Pharmacological Basis of Therapeutics, 8th Edn. New York: Pergamon Press, 1990; 513
[44] Sahni N, Panda NB, Jain K, Batra YK, Dhillon MS, Jagannath P. Comparison of different routes of administration of clonidine for analgesia following anterior cruciate ligament repair. J Anaesthesiol Clin Pharmacol 2015; 31(4):491-495
[45] Chakraborty S, Chakrabarti J, Mandal MC, Hazra A, Das S. Effect of clonidine as adjuvant in bupivacaine-induced supraclavicular brachial plexus block: A randomized controlled trial. Indian J Pharmacol. 2010;42:74–7.
[46] Onesti G, Schwartz AB, Kim KE, et al. Antihypertensive effect of clonidine. Circ Res. 1971;28suppl 253–69
[47] Weerink MA, Struys MM, Hannivoort LN, Barends CR, Absalom AR, Colin P. Clinical pharmacokinetics and pharmacodynamics of dexmedetomidine. Clinical pharmacokinetics. 2017 Aug;56(8):893-913.
[48] Angst MS, Ramaswamy B, Davies MF, Maze M. Comparative analgesic and mental effects of increasing plasma concentrations of dexmedetomidine and alfentanil in humans. The Journal of the American Society of Anesthesiologists. 2004 Sep 1;101(3):744-52.
[49] Grewal A. Dexmedetomidine: New avenues. J Anaesthesiol Clin Pharmacol 2011; 27(3): 297-302
[50] Pöpping DM, Elia N, Marret E, Wenk M, Tramèr MR. Clonidine as an adjuvant to local anesthetics for peripheral nerve and plexus blocks: a meta-analysis of randomized trials. Anesthesiology. 2009;111:406–415
[51] Eisenach JC, De Kock M, Klimscha W. alpha(2)-adrenergic agonists for regional anesthesia. A clinical review of clonidine (1984-1995). Anesthesiology. 1996;85:655–674
[52] Abdallah FW, Brull R. Facilitatory effects of perineural dexmedetomidine on neuraxial and peripheral nerve block: A systematic review and metaanalysis. Br J Anaesth 2013;110:915-25.
[53] Shrestha BR, Maharjan SK, Tabedar S. Supraclavicular Brachial Plexus Block with and without Dexamethasone - a Comparative Study. Kathmandu Univ Med J. 2003;1(3):158–60
[54] Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without dexamethasone - a comparative study. International Journal of Scientific and Research Publications. 2012;2(12):1–7.
[55] Albrecht E, Kern C, Kirkham KR. A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. Anaesthesia. 2015;70:71–83.
[56] Castillo J, Curley J, Hotz J, Uezono M, Tigner J, Chasin M, et al. Glucocorticoids prolong rat sciatic nerve blockade in vivo from bupivacaine microspheres. Anesthesiology. 1996;85:1157–66.
[57] Yaghoobi S, Seddighi M, Yazdi Z, et al. Comparison of postoperative analgesic effect of dexamethasone and fentanyl added to lidocaine through axillary block in forearm fracture. Pain Res Treat 2013; 2013: 761583.
[58] Arjun BK, Chetan L, Nagaraj AS et al. Comparison of dexamethasone 4 mg and 8 mg as an Adjuvant to 0.5% bupivacaine in supraclavicular brachial plexus block for upper limb surgeries: A randomised clinical study. J Evol Med Dent Sci 2019; 8(41): 3084–3088.
[59] Cummings KC, Napierkowski DE, Parra-Sanchez I, et al. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth 2011; 107(3): 446–453
[60] Brummett CM, Norat MA, Palmisano JM, Lydic R. Perineural administration of dexmedetomidine in combination with Bupivacaine enhances sensory and motor blockade in sciatic nerve block without inducing neurotoxicity in rat. Anesthesiology. 2008;109:502–11.
[61] Kosugi T, Mizuta K, Fujita T, Nakashima M, Kumamoto E. High concentration of dexmedetomidine inhibits compound action potential in frog sciatic nerve without adrenoreceptor activation. Br J Pharmacol. 2010;160:1662–1676.
[62] Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. Anaesth Analg. 2010;111:1548–1551.
[63] Sindjelic RP, Vlajkovic GP, Davidovic LB, Markovic DZ, Markovic MD. The addition of fentanyl to local anaesthetics affects the quality and duration cervical plexus block: A randomized controlled trial. Anaesth Analg. 2010;111:234–7.
doi: 10.1213/ANE.0b013e3181e1e9ab.
[64] Swaro SW, Karan DA, Banerjee SW. Comparison of fentanyl and dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block: a randomized-double blind prospective study. Asian J Pharm Clin Res. 2016;9(5):74-7.
[65] Patra S, Chanda R, Biswas C. Comparison of perineural administration of dexmedetomidine and fentanyl as an adjuvant to 0.5% bupivacaine to enhance the quality of supraclavicular brachial plexus nerve block in upper limb surgeries-A prospective, triple-blind, randomized study. Asian Journal of Medical Sciences. 2022 Jul 1;13(7).

[66] Swami S. S, Keniya V. M, Ladi S. D and Rao R. Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised doubleblind prospective study. Indian journal of anaesthesia (2012); 56(3): 243
[67] More P, Basavaraja LV. A comparison of dexmedetomidine and clonidine as an adjuvant to local anaesthesia in supraclavicular brachial plexus block for upper limb surgeries. JMR. 2015;1:142-7.
[68] Tripathi A, Sharma K, Somvanshi M, Samal RL. A comparative study of clonidine and dexmedetomidine as an adjunct to bupivacaine in supraclavicular brachial plexus block. Journal of anaesthesiology, clinical pharmacology. 2016 Jul;32(3):344.
[69] F. W. Abdallah and R. Brull, "Facilitatory efects of perineural dexmedetomidine on neuraxial and peripheral nerve block: a systematic review and meta-analysis," British Journal of Anaesthesia, vol. 110, no. 6, pp. 915–925, 2013
[70] Koul V, Sakshi Hk, Ranjan P. Clonidine and fentanyl as adjuvants with 0.5% bupivacaine in supraclavicular brachial plexus block for upper limb surgery. Int J Acad Med Pharm. 2023;5(4):1086-91.
[71] Ahmed, N. U, Hossain, M, Akhtaruzzaman, A. K. M, Mondol, M. K and Khatun U. S. Addition of clonidine or fentanyl with bupivacaine for supraclavicular brachial plexus blocks in upper limb surgery-a randomized comparative study. Journal of the bangladesh society (2011); 24(1): 3
[72] Naveen P, Gupta VK, Agarwal A. 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. J Clin Anesthes Res. 2021;2(1):1-6.
[73] Dejong RH, Wagman IH. Physiological mechanisms of peripheral nerve block by local anesthetics. Anesthesiology. 1963;24:684–727
[74] Meena MR, Tungria H, Tyagi G, Banu A, Raiger LK. A prospective, randomized, double blind, systemic controlled trial to compare analgesic efficacy of clonidine and fentanyl in supraclavicular block with 0.75% ropivacaine. Indian Journal of Clinical Anaesthesia. 2018 Oct;5(4):518-22.
[75] Nagabhushanam, Ponnapalli A Comparative Study between Fentanyl and Dexamethasone as Adjuvants in Supraclavicular Brachial Plexus Block With 0.5% Levobupivacaine SAS Journal of Surgery 2020 Jan; DOI: 10.36347/sasjs.2020.v06i01.004.
[76] Pathak RG, Satkar AP, Khade RN. Supraclavicular brachial plexus block with and without dexamethasone–a comparative study. International journal of scientific and research publications. 2012 Dec;2(12):1-7
[77] Talukdar M, Begum H, Shoman MM, Khatun UH, Talukdar M. Anaesthetic and analgesic effects of adding dexamethasone to bupivacaine in supraclavicular brachial plexus block–a comparative study. Journal of Bangladesh College of Physicians and Surgeons. 2013 Jan;31:11-7.
[78] Shrestha BR, Maharjan SK, Shrestha S, Gautam B, Thapa C, Thapa PB, Joshi MR. Comparative study between tramadol and dexamethasone as an admixture to bupivacaine in supraclavicular brachial plexus block. JNMA J Nepal Med Assoc. 2007 Oct 1;46(168):158-64.
[79] Hashim RM, Hassan RM. The efficacy of adjuvants to bupivacaine in ultrasound-guided supraclavicular block: a comparative study between dexmedetomidine, ketamine, and fentanyl. Ain-Shams Journal of Anesthesiology. 2019 Dec;11:1-8.
[80] Lashgarinia M, Naghibi K, Honarmand A, Safavi M, Khazaei M. Effect of ketamine as an adjuvant in ultrasound-guided supraclavicular brachial plexus block: A double-blind randomized clinical trial study. Advanced Biomedical Research. 2014;3.
[81] Youssef M, Elsayed S, Abd El-Mottalb E, Tarabai G. Efficacy of adding ketamine, dexamethasone, and epinephrine with bupivacaine in ultrasound-guided supraclavicular brachial plexus block. Research and Opinion in Anesthesia and Intensive Care. 2020 Apr 1;7(2):188-9.