Original Research Paper

Volume - 13 | Issue - 07 | July - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

BUPIVACAINE 0.5% WITH DEXMEDETOMIDINE AND BUPIVACAINE 0.5% WITH FENTANYL IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES FOR POSTOPERATIVE ANALGESIA- AN ANALYTICAL OBSERVATIONAL STUDY

Ujjwala Bhiku Khairmode	Associate Professor, GMC Miraj.
Sarita Thanekar	Assistant Professor, GMC Miraj.
Madhura M Nargund*	Former Senior Resident, GMC Miraj. *Corresponding Author
Samiksha Kulkarni	Assistant Professor, GMC Miraj

ABSTRACT Brachial plexus block is most widely used block for upper limb surgeries and is mainly associated with excellent intra and post-op analgesia, superior patient compliance and minimal side effects with almost 100% success rate of block. Blockade occurs at the distal trunk- proximal division level. At this point, the brachial plexus is compact and a small volume of solution produces rapid onset of reliable blockade of the brachial plexus.(1,2) Dexmedetomidine, an alpha α2 (α2) adrenergic agonist with some α1 adrenergic properties, has been used as an adjuvant to local anaesthetics in various regional anaesthesia techniques to extend the duration of blockade. This property has been attributed to the fact that α2 adrenergic agonists enhance the nerve block of local anesthetics by facilitation of C fiber blockade, by local vasoconstriction or by spinal action caused by diffusion along the nerve or retrograde axonal transport.(3) Fentanyl could act directly on the peripheral opioid receptor as primary afferent tissues (dorsal roots) have been found to contain opioid binding sites.(4) Addition of fentanyl to local anesthetics is known to significantly improve duration of sensory and motor block in brachial plexus blocks. This study was conducted to evaluate the effect of dexmedetomidine with bupivacaine and fentanyl with bupivacaine for upper limb surgeries.

KEYWORDS : Supraclavicular block, Fentanyl, Dexmedetomidine

MATERIALS AND METHODS

This is a prospective controlled study carried out at a tertiary care government hospital for a period of 1 year and 6 months (January 2019-June 2020)

All patients of upper limb surgeries who were operated during the course of study period coming within the inclusion criteria were included.

Sample Size

The sample size considered was 85 and 5 patients lost follow up, so actual sample size was 80 patients.

Inclusion Criteria

All patients of upper limb surgeries aged between 18-60 years of either gender coming under ASA I-II

Exclusion Criteria

1. Patient refusal
2. Any known bleeding disorder
3. Neurological deficits involving brachial plexus
4. Patients with allergy to local anaesthetics
5. Local infection at the injection site
6. BMI > 35
7. Patients on anti-hypertensives & antidepressants
8. ASA grade III-IV

Investigations

Complete hemogram, urine routine, blood sugar level, X ray chest > 50years of age or when indicated, blood urea nitrogen, electrocardiogram if age above 40 year

Drugs And Dosages

Two Groups

Group N: fentanyl (50µg) and bupivacaine (0.5%) 28ml, total of 30ml
Group M: dexmedetomidine (50µg) and bupivacaine (0.5%) 28ml, total of 30ml

Monitoring

Standard monitors like Pulse oximeter for saturation (SpO2) , ECG for rate and rhythm , manual blood pressure recording using sphygmomanometer are attached.

Instruments

Insulated stimulator needle, Peripheral nerve stimulator, ECG electrode, two 20ml luerlock syringes, skin marking pencil, one tuberculin syringe of 1ml, two stainless steel bowls one each for iodine and spirit, sterile gauze pieces, one sterile swab holding forceps, and one sterile drape.

Methodology (5,6,7)

With head turned slightly to the opposite side, patient in supine position without a pillow. The arm is kept by the side of patient so that his fingers touch the knee. Facing the foot of the table, the anesthesiologist performs the block standing at the side of the patient. Under aseptic conditions, the area is prepared and draped. 1 cm above the mid point of the clavicle, the subclavian artery pulsation is felt, the tip of the index finger is rested in the supraclavicular fossa directly over the arterial pulsations and the artery is retracted medially inwards and downwards. Then the block is given using the nerve stimulator.

Those patients who received fentanyl were in Group N fentanyl (50µg) with bupivacaine (0.5%) 28ml, total of 30ml and those patients who received dexmedetomidine were in Group M dexmedetomidine (50µg) with bupivacaine (0.5%) 28ml, total of 30ml decided as per preference of senior anesthetist.

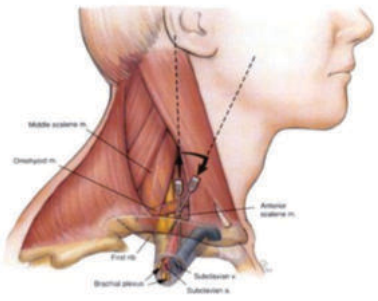

Figure 1 : Technique Of Supraclavicular Brachial Plexus

Parameters To Be Studied

➢ Onset Of Sensory Block

i;e time from injection to onset of analgesia in each of the major peripheral nerve distributions (ulnar, medial radial and musculocutaneous).

i. Sensory block was assessed using pinprick with a blunt end of a 27

gauge needle at 0,2,5,10,15,20 minutes.

Sensory block was graded according to the following scale:
0- no block (normal sensation),
1- partial block (decreased sensation),
2- complete block (no sensation)

➢ ONSET OF MOTOR BLOCK i.e; time of injection to the inability of the patient to move his/her finger or raise hand. Motor block will be measured at 0, 10, 20 minutes by assessing the following motor functions: flexion at the elbow (musculocutaneous nerve), extension at elbow and wrist (radial nerve), opposition of thumb and index finger (median nerve), and opposition of thumb and small finger (ulnar nerve).

Motor block was measured according to Modified Bromage scale,
Bromage-0 - No weakness, able to straight leg raise against resistance
Bromage-1 - Patient is unable to straight leg raise, but able to flex knee.
Bromage-2 - Patient is unable to flex knee, but with free movement of feet.
Bromage-3 - Patient is unable to move leg or feet.

➢ DURATION OF ANALGESIA
During the procedure, anesthesia will be considered satisfactory if the patient does not complain of pain or discomfort or if no sedation will be required. Post-operative follow up will be carried out in the recovery and the postoperative ward. The duration of analgesia will be noted and intensity charted as 0-10 according to visual analogue scale for pain at every 3hrs for 24 hours. When the patient complains of worst pain (VAS 8-10), it will be considered that the analgesic action of the drug has been terminated and rescue analgesic (I.M Diclofenac 1-1.5mg/kg) to be given.

➢ DURATION OF MOTOR BLOCK
Duration of motor block postoperatively will be assessed every hourly by asking the patients to move their fingers and to see whether they are able to raise their hands or not. This time will be recorded and taken as cessation of motor block effect.

➢ ONSET OF PAIN AND REQUIREMENT OF RESCUE ANALGESIA WILL BE ASSESSED BY VAS SCORE AS FOLLOWS :
a) (VAS _0') Patient is comfortable.
b) (VAS _1-3') Mild pain.
c) (VAS _4-6') Moderate pain.
d) (VAS _7-10') Severe pain.

➢ POSSIBLE SIDE EFFECTS
Incidence of drowsiness, pruritus, nausea/vomiting, pneumothorax, respiratory depression, bradycardia, hypotension & signs and symptoms of local anesthetic toxicity was looked for and noted if any. Any other side effects were also noted.

Figure 2: Peripheral Nerve Stimulator

Statistical Analysis (8,9,10)
Collected data was be analyzed by appropriate statistical methods.
- For between the group assessment of objective parameters, Mann Whitney U tests and Z test for means was applied with 5% level of significance.
- For assessment of intraoperative side effects (nausea, vomiting, pulmonary depression), Chi square test was applied at 5% level of significance.

Statistical Analysis: (11,12)
Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions.

Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation.

Independent t test or Mann Whitney U test was used as test of significance to identify the mean difference between two quantitative variables and qualitative variables respectively.

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

Table 1: Mean Onset Of Sensory Block And Motor Block In Mins Comparison Between Two Groups

	Group				p value
	Group M		Group N		
	Mean	SD	Mean	SD	
Onset of Sensory Block(Min)	10.08	1.33	11.1	0.93	< 0.001*
Onset of Motor Block(Min)	12.08	1.33	13.83	0.98	< 0.001*

Mean Onset of Sensory Block(Min) in Group M was 10.08 ± 1.33 and in Group N was 11.1 ± 0.93. There was a significant difference in mean Onset of Sensory Block(Min) comparison between two groups.

Mean Onset of Motor Block(Min) in Group M was 12.08 ± 1.33 and in Group N was 13.83 ± 0.98. There was a significant difference in mean Onset of Motor Block(Min) comparison between two groups.

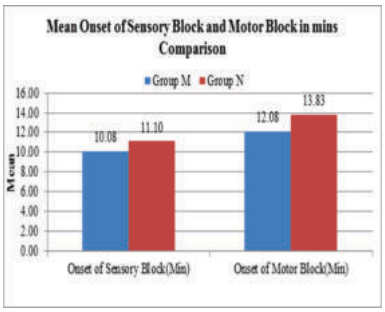

Figure 3: Bar Diagram Showing Mean Onset Of Sensory Block And Motor Block In Mins Comparison Between Two Groups

Table 2: Mean Maximum Sensory Block And Motor Block In Mins Comparison Between Two Groups

	Group				p value
	Group M		Group N		
	Mean	SD	Mean	SD	
Maximum Sensory Block (Min)	16.2	2.59	19.88	2.48	< 0.001*
Maximum Motor Block (Min)	20.58	2.16	21.65	2.21	0.031*

Mean Maximum Sensory Block (Min) in Group M was 16.2 ± 2.59 and in Group N was 19.88 ± 2.48. There was a significant difference in mean Maximum Sensory Block in mins comparison between two groups.

Mean Maximum Motor Block (Min) in Group M was 20.58 ± 2.16 and in Group N was 21.65 ± 2.21. There was a significant difference in mean Maximum Motor Block in mins comparison between two groups.

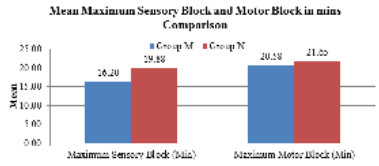

Figure 4: Bar Diagram Showing Mean Maximum Sensory Block And Motor Block In Mins Comparison Between Two Groups

Table 3: Mean Duration Of Sensory Block And Motor Block In Hrs Comparison Between Two Groups

	Group				p value
	Group M		Group N		
	Mean	SD	Mean	SD	
Duration of Sensory Block(hrs)	11.33	1.07	10.4	0.59	< 0.001*
Duration of Motor Block(hrs)	13.25	1.13	11.2	1.02	< 0.001*

Mean Duration of Sensory Block(hrs) in Group M was 11.33 ± 1.07 and in Group N was 10.4 ± 0.59. There was a significant difference in mean Duration of Sensory Block(hrs) comparison between two groups.

Mean Duration of Motor Block(hrs) in Group M was 13.25 ± 1.13 and in Group N was 11.2 ± 1.02. There was a significant difference in mean Duration of Motor Block(hrs) comparison between two groups.

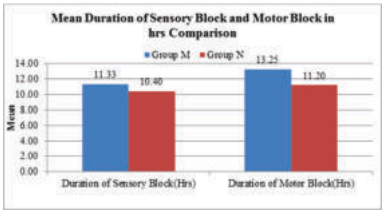

Figure 5: Bar Diagram Showing Mean Duration Of Sensory Block And Motor Block In Mins Comparison Between Two Groups

Table 4: Mean Vas Score Comparison Between Two Groups At Different Intervals Of Time

VAS Score	Group				p value
	Group M		Group N		
	Mean	SD	Mean	SD	
3 hrs	2.78	1.27	3.03	1.35	0.396
6 hrs	4.2	1.22	4.23	1.37	0.932
9 hrs	5.08	0.8	4.4	1.03	0.002*
12 hrs	3.5	0.72	3.55	0.64	0.743
18 hrs	3.2	0.91	2.95	0.96	0.236
24 hrs	4.68	1.25	4.75	1.24	0.788

There was a significant difference in mean VAS Score Comparison between two groups at 9 hours and at other intervals there was no significant difference.

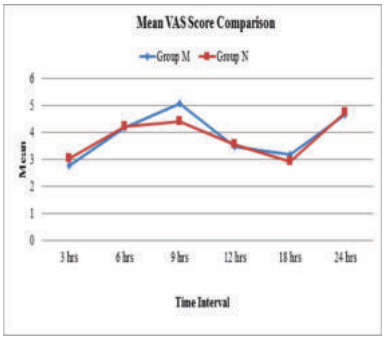

Figure 6: Line Diagram Showing Mean Vas Score Comparison Between Two Groups At Different Intervals Of Time

Table 5: Mean First Rescue Analgesia Given (hrs) Comparison Between Two Groups

	Group				p value
	Group M		Group N		
	Mean	SD	Mean	SD	
First rescue analgesia given (hrs)	10.2	2.13	9.13	1.45	0.01*

Mean First rescue analgesia given (hrs) in Group M was 10.2 ± 2.13 and in Group N was 9.13 ± 1.45.

There was a significant difference in mean First rescue analgesia given (hrs) comparison between two groups.

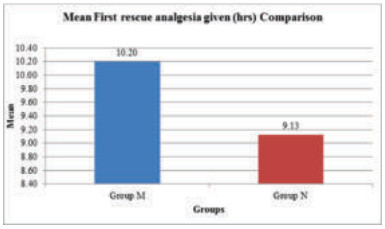

Figure 7: Bar Diagram Showing Mean First Rescue Analgesia Given (hrs) Comparison Between Two Groups

Table 6: Mean Of # Rescue Analgesia In 24 Hrs Comparison Between Two Groups

	Group				p value
	Group M		Group N		
	Mean	SD	Mean	SD	
Mean of #rescue analgesia in 24 hrs	2	0	2.53	0.51	< 0.001*

Mean of # rescue analgesia in 24 hrs in Group M was 2 ± 0 and in Group N was 2.53 ± 0.51.

There was a significant difference in mean # of rescue analgesia in 24 hrs comparison between two groups.

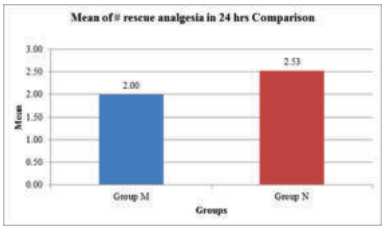

Figure 8: Bar Diagram Showing Mean Of # Rescue Analgesia In 24 Hrs Comparison Between Two Groups

Table 7: Side Effects Distribution Between Two Groups

		Group			
		Group M		Group N	
		Count	%	Count	%
Nausea	No	40	100.00%	40	100.00%
Vomiting	No	40	100.00%	40	100.00%
Hypotension	No	40	100.00%	40	100.00%
Bradycardia	No	40	100.00%	40	100.00%

DISCUSSION

Peripheral nerve blocks have become an integral part of surgical anesthesia and postoperative analgesia, amongst which supraclavicular brachial plexus block is widely practiced technique for upper extremity surgeries.

Dexmedetomidine, a newer drug with selective agonist activity at alpha 2 adrenoreceptor have been used for many years as a centrally acting antihypertensive agent.

Addition of dexmedetomidine with bupivacaine in the brachial plexus block prolongs anaesthesia, analgesia and reduces side effects.(9) Fentanyl – bupivacaine combination is used in spinal, epidural and brachial plexus block .Their uses has been established because its onset is rapid , anesthesia is more complete and provides prolonged analgesia.(13)

This study was conducted in a tertiary care government hospital after obtaining permission from the ethical committee and written informed consent was obtained from each patient. 80 patients under ASA I and II within the age group of 18 to 60 years, posted for elective upper limb surgery were divided into 2 groups of 40 each (group M & group N) using computer generated random number table.

Group N received brachial plexus block with 30 ml of 0.5% bupivacaine and 50 µg fentanyl whereas Group M received brachial plexus block with 30 ml of 0.5% bupivacaine with 50 µg

dexmedetomidine.

Parameters observed included onset of sensory blockade, onset of motor blockade, duration of sensory blockade, duration of motor blockade and duration of postoperative analgesia.

1. Duration Of Analgesia

The mean time from onset of block to request of 1st analgesic is taken as total duration of analgesia. It was 10.2 ±2.13 hrs in dexmedetomidine group and 9.13 ± 1.45 hrs in fentanyl group which is statistically significant p = < 0.001.

According to Mohamed Ahmed Hamed (2018)in their study dexmedetomidine reduced the use of supplementary intravenous anesthetic agents for surgery and produced dose dependent prolongation of analgesia, It reached a mean 13.5hrs for the dose 50 µ compared to 8.3 hrs for fentanyl which matches well with our study. (14)

Our study observations concur well with study conducted by Nasir Uddin Ahmed in supraclavicular block with dexmedetomidine using the dose of 50 µg and 30 ml bupivacaine of 0.5 %. The block produced with the addition of dexmedetomidine was longer (14.4 ± 1.3 hrs.) compared to fentanyl as adjuvant (10.9 ± 1.5 hrs.) Rescue analgesic requirements : In post op 24 hours

In our study, the rescue analgesia requirement in post operative 24 hours was 2 in both groups (M & N).(15)

2. Onset Of Sensory Block

In our study, we observed that onset of sensory block was later in the study group of fentanyl having a mean value of 11.1 ± 0.93 min in comparison with dexmedetomidine having mean value of 10.08 ± 1.33 min, which is statistically significant (p = < 0.001)

This observation matches well with the study of Mohamad Ahmad Hamid who compared the effectiveness of dexmedetomidine and fentanyl as an adjunct to bupivacaine in supraclavicular nerve block. There is statistically significance difference with P < 0.05 between study groups as regards onset of sensory block was with low mean among Group D(dexmedetomidine) sensory

5.75 ± 2.2 min and in Group F(fentanyl) sensory block onset was 11.8 ± 3.4 min.(14)

Nasir Uddin Ahmed in his study , found that onset of sensory block was higher in dexmedetomidine group 11.9 ± 2.7 min compare to fentanyl group 8.9 ± 2.9 min. These observation were slightly different from our study.(46)

3. Onset Of Motor Block

In our study, we observed that onset of motor block was later in the study group of fentanyl having the mean value of 13.83 ± 0.98 min and in comparison, the dexmedetomidine group had a mean value of 12.08 ± 1.33 min. which is statistically significant (p = < 0.001)

This observation matches well with the study conducted by Mohamad Ahmed Hamed who had onset of motor blockade in fentanyl group compared to dexmedetomidine group,13.7 ± 3.3 min and 6.85 ± 2.4 min respectively.(14)

In Nasir Uddin Ahmed study that onset of motor block was higher in dexmedetomidine group 11.9 ± 2.7 min compare to fentanyl group 8.9 ± 2.9 min. these observation were different to our study.(15)

Preeti Rustagi, in a study found that onset of motor block was 13 min earlier in dexmedetomidine group compared to plain bupivacaine which is matching our study.(16)

4. Duration Of Sensory Block

The duration of sensory blockade, in our study was 11.33±1.07 hours with dexmedetomidine group and 10.4±0.59 hours for fentanyl group, which is statistically significant (p= <0.0001).

In a study done by Prashant Sirohiya, the average duration of sensory block was 280.5 ± 101.79 min in control group and in dexmedetomidine significantly prolonged the duration of block to 474.33±166.64 min.(17)

Smitha K. Vikraman, conducted duration of sensory block in the ropivacaine dexmedetomidine group was 682.91 ± 42.12 minutes while in the ropivacaine-only group, it was 487.64 ± 20.59 minutes which is similar to our study.(18)

5. Duration Of Motor Block

In our study, the duration of motor blockade was found to be 13.25 ± 1.07 hours in group M compared to group N 11.2 ± 1.02 hours and this difference was statistically significant (p=0.001).

In the study conducted by Mohamad Ahmad Hamed , the average duration of motor block was 364.5 ± 33.3 min in fentanyl group whereas dexmedetomidine significantly prolonged the duration of block to 558 ± 66.4 min.(14)

According to the study conducted by Mohamed Ahmed Hamed , the duration of motor blockade in the bupivacaine group was 420 min in control, and in comparison fentanyl group had 465 min, which are matching well with our study.(14)

In the study conducted by Prashant Sirohiya , dexmedetomidine provided the duration of motor block effect that lasted as long as 515 min which is more the duration of control group 307 min.(17)

Smitha K. Vikraman, conducted the duration of motor block in dexmedetomidine group was 533.98 minutes while in control group it was 335.98 ± 23.85 minutes, which is similar to our study.(18)

6. No Complications Like Nausea, Vomiting, Hypotension, Bradycardia Were Noted In Both Fentanyl (group N) And Dexmedetomidine (group M) Postoperatively In Our Study.

According to a study conducted by Tuhin Vashishth, Mahesh Verma.they observed that nausea and vomiting was found to be in higher proportion in fentanyl group as compared to dexmedetomidine group but this difference was statistically not significant (p=0.181), which matches with our study.(19)

In their study, Massad IM, found that combining dexmedetomidine to other anaesthetic agents, leads to a balanced anaesthesia and a significant drop in the incidence of PONV postoperatively and this is similar to our study.(20)

Another study conducted by Gupta R, Verma R stated that complications such as shivering, nausea and vomiting, were not statistically significant between the two groups, which was in agreement with the results of our study.(21)

CONCLUSION

The present study was conducted to determine the quality and duration of postoperative analgesia in both fentanyl and dexmedetomidine with bupivacaine in supraclavicular brachial plexus block in upper limb surgery .

The time for demand of rescue analgesics was significantly prolonged in dexmedetomidine group M (130.2 ± 2.13 hrs) compared to fentanyl group N (9.13 ± 1.45hrs). This difference was also statistically significant (p= <0.001).

In this study, the rescue analgesia requirement in post operative 24 hours was 2 in both groups (M & N).

Onset of sensory blockade (time between injection and total loss of sensation to temperature) was slower in fentanyl group N (11.1 ± 0.93min) compared to dexmedetomidine group M (10.8 ± 1.33 min), which was statistically significant.

Onset of motor blockade was slower in fentanyl group N (13.83 ± 0.98 min) compared to dexmedetomidine group M (12.08 ± 1.33 min) which was statistically significant.

The duration of sensory blockade (the time between injection and complete recovery from sensory disturbance) was also longer in dexmedetomidine group (11.33 ± 1.07 hours) compared to fentanyl group (10.4 ± 0.59 hours) and this difference was both clinically and statistically significant.

The duration of motor blockade was longer in dexmedetomidine group M (13.25 ± 1.13 hours) compared to fentanyl group N (11.2 ± 1.02 hours) and this difference was both clinically and statistically

significant .

No complications like nausea, vomiting, hypotension, bradycardia were noted in both fentanyl (group N) and dexmedetomidine (group M) postoperatively in our study.

From this study, it was evident that dexmedetomidine bupivacaine combination was more effective than fentanyl bupivacaine in reducing intensity of postoperative pain.

We thus concluded that both fentanyl and dexmedetomidine are good adjuvant with bupivacaine for supraclavicular brachial plexus block. However dexmedetomidine has a faster onset with longer duration and no complications were noted.

REFERENCES

1. Misiolek HD, Kucia HJ, Knapik HJ, Werszner MM,Karpe JW,Grumprecht J.Brachial plexus block with ropivacaine and bupivacaine for the formation of arteriovenous fistula in patients with end-stage renal failure.European Journal of Anesthesiology-2005;22:471-484.
2. Sarita SS, Varshali Mk, Sushma DL, Ruchika R, Indian journal of anaesthesia Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study 2012 May-Jun; 56(3): 243-249.
3. Ronald D Miller, Lars I Erikson, Lee A Fleisher, Jean P Wiener-Kronish, William L Young, editors. Millers anesthesia. 17th ed. Published in United States of America: Churchill Livingstone Elseiver; 2010. p.1624. (Spinal Anesthesia by David L Brown; Section 4, Chapter5, Volume2).
4. Rajkhowa T, Das N, Parua S. Fentanyl as an adjuvant for brachial plexus block: A randomized comparative study. Int J Clin Trials 2016;3:64□7.
5. Hardman JG, Limbird LE. Goodman and Gilman's the pharmacological basis of therapeutics. 10th Ed. USA: McGraw Hill; 2001.
6. Dr.S.Rambabu "A Comparative Study Of Clonidine Vs Dexamethasone As adjuvants With Local Anesthetic In Supraclavicular Brachial Plexus Block.". "IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), Volume 17, Issue 2 (2018), PP 55-64.
7. Department of Anesthesiology and Critical Care, Institute of Liver and Biliary Sciences, New Delhi, Department of Anesthesiology, Byramjee Jeejeebhoy Medical College and Sassoon Hospital, Pune, Maharashtra, India.
8. Dakhale GN, Hiware SK, Shinde AT, Mahatme MS. Basic biostatistics for post-graduate students. Indian J Pharmacol. 2012;44(4):435-442.
9. Sunder Rao P S S , Richard J (2006) : An Introduction to Biostatistics, A manual for students in health sciences , New Delhi: Prentice hall of India. 4th edition, 86-160.
10. Elenbaas, RM, JK, Cuddy, PG. Evaluating the medical literature, part II: Statistical analysis.Ann Emerg Med. 1983;12:610–620.
11. Gaddis, ML, Gaddis, GM. Introduction to biostatistics: Part 4, Statistical inference techniques in hypothesis testing. Ann Emerg Med. 1990;19:820– 825.
12. Patra P. Sample size in clinical research, the number we need. Int J Med Sci Public Health. 2012;1:5–9.
13. Deniz Karakaya, Fazil Bayu Kgoz, Sibel Baris, Fuat Guldogus et al. Regional Anesthesia, 1st edition, Martin Dunitz Ltd, UK, 2002; 40.
14. Hamed MA, Ghaber S, Reda A. Dexmedetomidine and fentanyl as an adjunct to bupivacaine 0.5% in supraclavicular nerve block: A randomized controlled study. Anesth Essays Res 2018;12:475□9.
15. Nasir Uddin Ahmed, Journal of the Bangladesh Society of Anesthesiologists Vol. 24, No. 1, January 2011(3-7).
16. Rustagi P, Patkar GA, Malpani Y, Tendolkar BA. Clonidine as an adjuvant to local anesthetic in supraclavicular brachial plexus block: a randomized, double blinded placebo controlled study. Int J Basic Clin Pharmacol 2016;5:1892-7
17. Sirohiya P, Mantan K, Rehman H, Kumari M, Devra V, Singh R. Effect of bupivacaine and bupivacaine-clonidine combination in supraclavicular brachial plexus block – A comparative study. IAIM, 2016; 3(5): 29-37.
18. 49Smitha K. Vikraman et al JMSCR Volume 05 Issue 04 April 2017, Page 20580-20584.
19. Tuhin Vashishth, Mahesh Verma. A comparative study of dexmedetomidine and fentanyl with ropivacaine 0.75% in epidural analgesia in lower limb orthopedic surgeries.National Journal of Medical and Dental Research, April-June 2016: Volume-4, Issue-3, Page 201-212.
20. Massad IM, Mohsen WA, Basha AS, Al-Zaben KR, Al-Mustafa MM, Alghanem SM. A balanced anaesthesia with dexmedetomidine decreases postoperative nausea and vomiting after laparoscopic surgery. Saudi Med J.2009;30:1537– 41.
21. Gupta R, Verma R, Bogra J, Kohli M, Raman R, Kushwaha JK. A comparative study of intrathecal Dexmedetomidine and fentanyl as adjuvants to bupivacaine. J Anaesthesiol Clin Pharmacol. 2011;27 (3):339. doi:10.4103/0970-9185.83678