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INTERSCALENE BRACHIAL PLEXUS ANAESTHESIA AND ANALGESIA FOR SHOULDER SURGERY: A COMPARATIVE STUDY BETWEEN BUPIVACAINE WITH FENTANYL AND BUPIVACAINE WITH DEXMEDETOMIDINE AS ADJUVANT

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Abstract –
Introduction - Interscalene nerve block is the technique of anesthetizing the roots
or trunks of the brachial plexus in the neck between the anterior and middle
scalene muscles typically performed to provide anaesthesia or analgesia for surgery of the shoulder and upper arm.
A variety of local anaesthetics can be used of which bupivacaine and ropivacaine are frequentlyused which produces effect similar to other local anesthesia via reversibleinhibition of sodium ion influx in nerve fibres.
Fentanyl is phenylpiperidine derivative synthetic opioid agonist,
structurally related to meperidine thatacts on specific opioid receptors at presynaptic and postsynaptic sites in CNS&Dexmedetomidine is a Food and Drug Administration (FDA) approved short term sedative and analgesic (<24 hours) The present aims to assess the anaesthetic and neuro analgesic effects of 0.5% bupivacaine with dexmedetomidine and 0.5% bupivacaine with fentanyl as adjuvant in brachial plexus block through interscalene root for shoulder surgery.
And compare the effects of dexmedetomidine and fentanyl as additives with bupivacaine in interscalene brachial plexus block on surgical anaesthesia, post operative analgesia, duration of sensory and motor blockade, hemodynamic changes, any side effects of the drugs, complications and safety of the technique, if any in the patients undergoing shoulder surgeries.

Materials & Methods – The study was carried out after obtaining written informed consent from each patient and approvalof Institutional Ethics Committee (H) with 70 numbers of ASA classes I and II patients aged between 20-60 years undergoing elective shoulder and proximal humerus surgeries for less than 2.5 hours .
The patients were randomly divided into two groups.One group was Group BF (n=35),wherebupivacaine0.5% with fentanyl was used and the other group was Group BD (n=35) where bupivacaine 0.5% with dexmedetomidine was used. Sensory & motor block characteristics were assessed with pinprick & Modified Bromage Scale. Haemodynamic changes & side effects were also observed& recorded . These were compared with the same stimulation in the contralateral hand. Statistical analysis was performed using Student t test and Chi square test.
Result-In our study, sensory block onset for BF group was found to be 9.84 ± 2.12 (min) and 7.17 ± 1.32 (min) in BD group showing significant difference (p<0.001).Motor block onset for BF was 15.36 ± 2.99 (min) and that of BD group was 10.77 ± 1.85mins(p<0.001).The duration of sensory block for BF group to be 465.20 ± 38.34 mins and 724.37 ± 43.36 mins for BD group (p<0.001).Duration of motor blockade was found to be 433 ± 37.64 mins for BF group and 682.43 ± 45.20 mins for BD group (p<0.001).
Mean time duration of analgesia for BF was 478.91 ± 37.90 mins and that of BD group to be 739 ± 38.79 mins. (p value <0.001)..In our study, heart rate showed a significant difference in both the group with p value <0.001 at 20 min, 25 min, 30 min, 45 min .Systolic blood pressure (SBP) showed significant difference between the two group at 20 min, 25 min, 30 min and, 45 min (p value <0.001). The mean value was lower in group BD compared to BF group. At other time no statistically significant difference was observed.
Diastolic blood pressure (DBP) showed significant difference between the two group at 20 min, 25 min, 30 min and, 45 min (p value <0.001). The mean value was lower in group BD compared to BF group.Mean arterial pressure (MAP) observed to show a significant difference statistically at 20 min, 25 min, 30 min, and also at 12th hour during study time with p value <0.001. the patients of group BD has lower MAP. None of the patient in both the group showed any hypotension (MAP<20 % of pre-operative value).There were no significant difference in SPO2 in both the group and none of the patient developed hypoxemia (SPO2 < 90%) during the study.
Sedation was reported in patient of BD group with the score of 2, 3, and 4. None in fentanyl group developed sedation score more than 2
Minor complication like Horner's Syndrome (HS) was seen in 14.29 % (5/35) patient in group BF and 17.14 % (6/35) patients in group BD. Hoarseness of voice was observed in 25.71 % (9/35) patient of BF group, while in BD group it was 22.86 % (8/35) patients. Only one patient developed ipsilateral diaphragmatic palsy in group BD.
Conclusion – Bupivacaine with Dexmedetomidine has faster onset of sensory and motor block with longer duration of sensory and motor block as well as duration of analgesia compared to Bupivacaine with Fentanyl. Hemodynamic changes were comparable among both the groups without any adverse effect and major complications.

Keywords-Interscalene brachial plexus anaesthesia, bupivacaine, fentanyl, dexmedetomidine

INTRODUCTION

Peripheral nerve blockade is one of the methods, which has brought a new dimension in Regional Anaesthesia and is a well acceptedanaesthetic technique. Its major advantage of not having the side effects of General Anaesthesia made it more popular. There is less interference with normal metabolic processes and vital functions, and particularly useful to patient withserious systemic diseases and chronic illness.

Interscalene nerve block is the technique of anesthetizing the roots or trunks of the brachial plexus in the neck between the anterior and middle scalene muscles. The procedure was first well

described and popularized by AlonWinnie in 1970[1]. Interscalene nerve block is typically performed to provide anaesthesia or analgesia for surgery of the shoulder and upper arm. [2,3,4,]

A variety of local anaesthetics can be used to perform ideal and complete block. Among them, bupivacaine and ropivacaine are frequently used which produces effect similar to other local anesthesia via reversible inhibition of sodium ion influx in nerve fibres.[5]

Bupivacaine is a long acting amide local anaesthetic. Chemically itis 1-butyl-n-(2, 6-dimethylphenyl) piperidine-2-carboxamide.Itsintroduction was a very important step in the evolution of regional anaesthesiaasit is utilised for intraoperative local anaesthesia, post-operative analgesia andchronic pain. It is commercially prepared as a racemic mixture containing equalproportions of the S (-) and R (+) isomers.However, the drug may be associatedwith a number of side effects like unwanted motor blockade, CNS toxicity andcardiotoxicity. [6]

Fentanyl is phenylpiperidine derivative synthetic opioid agonist,structurally related to meperidine. Acts on specific opioid receptors at presynaptic and postsynaptic sites in CNS (mainly in brainstem and spinal cord), as well as in periphery. [7,8,9]

Dexmedetomidine was approved in 1999 by the Food and Drug Administration (FDA) as a short term sedative and analgesic (<24 hours) for critically ill or injured people on mechanical ventilation in the intensive care unit(ICU). The rationale for its short term use was due to concerns over withdrawal side effects, such as rebound high blood pressure. Dexmedetomidine diminishes α-2 activation with release of norepinephrine from these nerve endings and other co-transmitters which are important in signal transduction. [10,11]

Local anaesthetics, singularly used for various regional blocks provide good operative conditions but have shorter duration of postoperative analgesia.Thus,variousadjuvants to local anaestheticsare employed to hasten the onset of block, to prolong the duration of analgesia in the post-operative period and to minimize side effects.

The current study aims to compare the effects of dexmedetomidine and fentanyl as adjuvants with bupivacaine 0.5% in interscalene brachial plexus block on surgicalanaesthesia, post operative analgesia, duration of sensory and motor blockade, hemodynamic changes, any side effects of the drugs, complications and safety of the technique, if any, in the patients undergoing shoulder surgeries.

MATERIALS & METHODS –
After taking approval of Institutional Ethics Committee (H), and obtaining written informed consent from each patient, a total sample size of 70 patients was taken based on inclusion & exclusion criteria.

Inclusion Criteria:
ASA classes I and II patients aged between 20-60 years who underwent elective shoulder and proximal humerus surgeries were selected for the study.

Exclusion Criteria:

Patient refusal to participate in the study, any allergic reactions to bupivacaine, fentanyl, dexmedetomidine and lignocaine, patients with hypertension, cardiac, hepatic or renal diseases. pregnant women, drug abusers and psychiatric patients.
Patient who had anatomical or vascular abnormality in the upper extremity, any bleeding diathesis or local infection of neck were also excluded from the study.

Study Design: Hospital based randomised cross-sectional study

Study Location: A tertiary care teaching hospital, Department of Anaesthesiology.

Procedure methodology -
Pre-operative check-up was done for all patients and written informed consent was taken. A detailed history was taken and thorough clinical examination was done and recorded.
All patients were explained about the trial and also about the visual analogue score (VAS) (0 - no pain, 10 - worst imaginable pain). Patients were kept fasting for 8 hours prior to surgery.
All precautionary measures were in place in the operating room with an Anaesthesia workstation, laryngoscopes, ETT, O2 cylinders, suction equipment and emergency drugs.
On arrival to the operation theatre, standard monitors were connected and the baseline monitors such as SpO2, electrocardiogram, pulse rate, non- invasive blood pressure and mean arterial pressure were recorded and monitored and throughout the procedures.

An IV line was secured with an 18G cannula and Ringer Lactate solution was started.
Premedication was done with Inj. ondansetron and Inj. pantoprazole.
All patients put for shoulder surgeries and who fulfilled the inclusion criteria was taken for the study till the sample size of 70 was reached. All the patients were divided randomly into two groups – In BF group, 15 ml of 0.5% bupivacaine with fentanyl (1µg/kg)diluted with normal saline (5 mL) to make a total volume of 20 mL was injected, while in BD group, 15 ml of 0.5% bupivacaine with dexmedetomidine(1µg/kg) diluted with normal saline (5 mL) to make a total volume of 20 mL was injected.

InterscaleneBrachial Plexus block was performed by using standard nerve stimulation techniqueby using 50mm, insulated needle and a peripheral nerve stimulator (Stimuplex®; B Braun, Melsungen, Germany).
The patient was positioned supine, with head turned away from the side tobeblocked. Upon antiseptic preparation the interscalene groove ispalpated by rolling the fingers posteriorly off the lateral border of sternocleidomastoid muscle , which lies immediately behind the posterior border of clavicular head of sternocleidomastoid muscle at the level of C6 vertebra. A skin wheal was raisedin the interscalene border by injecting 2% lignocaine plain solution of 1 ml,22- gauge, 35-50 mm insulated needle, was introduced through the wheal. Electrical stimulation of each nerve was done by starting the stimulation with current intensity of 1mA. Then the current intensity was decreased slowly to 0.05mA by redirecting the needle to obtain the best desired appropriate response. A volume of 20 ml of drugs was injected in small increments after continuous negative aspiration.
In BF group, 15mlof 0.5%bupivacaine with fentanyl (1µg/kg) diluted with normal saline (5 mL) to make a total volume of 20 mLwas injected by the assistant while the operator fixed the needle.
In BD group, 15 ml of 0.5% bupivacaine with dexmedetomidine (1µg/kg) diluted with normal

saline (5 mL) to make a total volume of 20 mLwas injected by the assistant while the operator fixed the needle.
Before interscalene block none of the patient was pre-medicated, but during the surgery each patient recieved midazolam 0.02 mg/kg.

Sensory Block was graded as:
Sensory block was assessed by loss of sensation to pinprick over the C5-C7 dermatome. Sensory blocked was assessed by using a 3 point scale:[12]

Grade	Characteristics
2	Anaesthesia, no sensation felt
1	Analgesia, dull sensation felt
0	Sharp pain felt

Duration of Sensory Blockade:
The duration of sensory blockade was the time interval between administration of local anaesthetics and appearance of first post-operative return of sensation to pin prick.[12]

Motor Block was graded as:
Motor blockwas assessed by asking the patient to abduct the arm at shoulder joint against gravity and flexion of forearm at the elbow joint. Motor blockade was assessed by using Modified Bromage Scale:[13]

Grade	Characteristics
4	Full power in arm and shoulder muscles
3	Reduced power but ability to move arm and shoulder against resistance
2	Ability to move against gravity but inability to move against resistance
1	Flicker of movement in arm and shoulder muscles
0	No movement in arm and shoulder muscles

Duration of Motor Blockade:
Duration of motor block was the time intervalthepatient havingcompleteparalysis of shoulder flexion and extension to the time the patient first flex the elbow.[12]

Quality of Block:
Overall quality of block was assessed on a 3-point scale:[13]

Grade	Characteristics
0	Complete failure
1	Inadequate block
2	Successful block

At the endof 30 min, ifthere is no sign of motor and sensory block, it was considered failed block

and the patient was excluded. However, if any patient complains of bearable pain or complains ofdiscomfortorpainintraoperative, they were managed with supplemental analgesia.

Duration of Analgesia:
It was calculate from the time of sensory onset to first dose of rescue analgesia requested. The rescue analgesia was given with injection diclofenac sodium 1.5 mg/kg i.v.
Systolic, diastolic and mean blood pressures, heart rate were all recorded just before injection, then at 5th minute, 10th minute, 15th minute, 20th minute, 25th minute, 30th minute, 45th minute, 1st hour, 2ndhour, 4th hour, 8th hour, and at 12th hour.

Each patient was observed for side effects like Horner's Syndrome, ipsilateral diaphragmatic palsy, hoarseness of voice, difficulty in swallowing, and complication like pneumothorax, vascular injury (external jugular vein puncture, hematoma formation), intra- arterial injection, epidural or spinal injection, neuropathy or nerve injury.

Degree of Sedation:
Degree of sedation was monitored using Ramsay sedation score:[14]

Level	Characteristics
1	Patient awake, anxious, agitated, or restless
2	Patient awake, cooperative, orientated, and tranquil
3	Patient drowsy, with response to commands
4	Patient asleep, brisk response to glabella tap or loud auditory stimulus
5	Patient asleep, sluggish response to stimulus
6	Patient has no response to firm nail-bed pressure or other noxious stimuli

STATISTICAL ANALYSIS –
The data were recorded on predesigned and pretested proforma, tabulated and a master chart was prepared. Demographic data, Heart Rate (HR), systolic BP, diastolic BP and Mean arterial pressure (MAP) were tabulated as Mean ± SD. Statistical significance were tested by Student t test and Chi square test wherever applicable. Microsoft Word and Excel have been used to generate graphs and tables. $p < 0.05$ was considered significant, $p < 0.01$ highly significant and $p < 0.001$ extremely significant.

RESULTS
Our study showed no statistical difference in the groups in terms of their demographic characteristics and the duration of surgery. (Table 1) In our study, shorter time of onset of sensory blockade seen in group BD.The mean time for onset of sensory block was 9.84 ± 2.12 min in group BF, and 7.17 ± 1.32 min in group BD showing a highly significant difference ($p < 0.001$) in the onset of sensory block time between the study groups..Also, we wound the mean duration of sensory block in group BF to be 465.20 ± 38.34 minutes and that of group BD to be 724.37 ± 43.36 minutesshowing prolonged action in group BD with a highly significant difference ($p < 0.001$) in the duration of sensory block time between the study groups. (Table 2)The mean time for onset of motor block was 15.36 ± 2.99 min in group BF and 10.77 ± 1.85 min in group BD. The motor block onset was shorter in group BD than in group BF. The p value (< 0.001) was highly significant statistically.The mean duration of motor block in group BF was 433 ± 37.64 mins and in group BD was 682.43 ± 45.20 mins showing prolonged duration of

actionin group BD in comparison to group BF which was highly significant statistically (p value <0.001(Table 2).The mean duration of analgesia was 478.91 ± 37.90 mins in group BF and 739 ± 38.79 mins in group BD. Statistically the result was highly significant (p value < 0.001) and duration of analgesia was longer in group BD.(Table 2)

On measuring the heart rate the patient in group BD showed a significant difference between the two groups with p value <0.001 at 20 min, 25 min, 30min 45 min and p value 0.01026 at 1st hour. The mean heart rate was lower in dexmedetomidine group. Three patients showed bradycardia at 25 min and 30 min, which does not, required any drug for management and it return to acceptable level at 45 min.(Table-3, Figure-1)

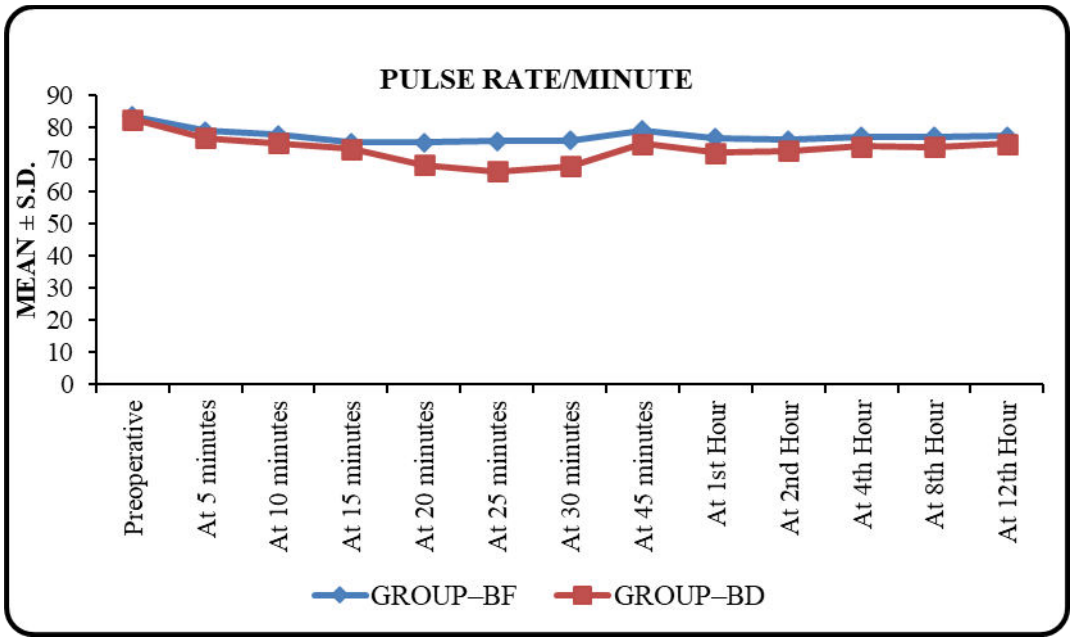

Figure-1

On measuring the systolic blood pressure the patients, the result showed significant difference between the two groups at 20 min, 25 min, 30 min and 45 min (p value < 0.001). At rest of the time there was no statistically significant difference noted in the two groups.(Table 4,Figure-2)

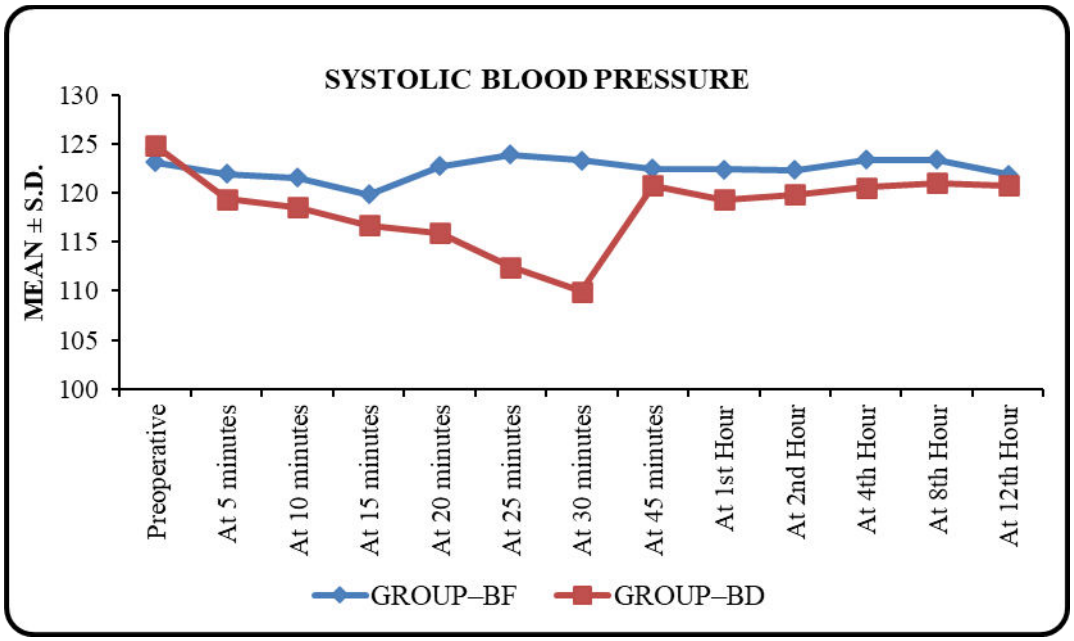

Figure-2

The diastolic blood pressure showed significant difference between the two groups at 20 min, 2 min, 30 min and 45 min (p value <0.001). The diastolic pressure showed lower level in group BD at these times and in rest of the time it had no significance difference between the two groups.(Figure-3)

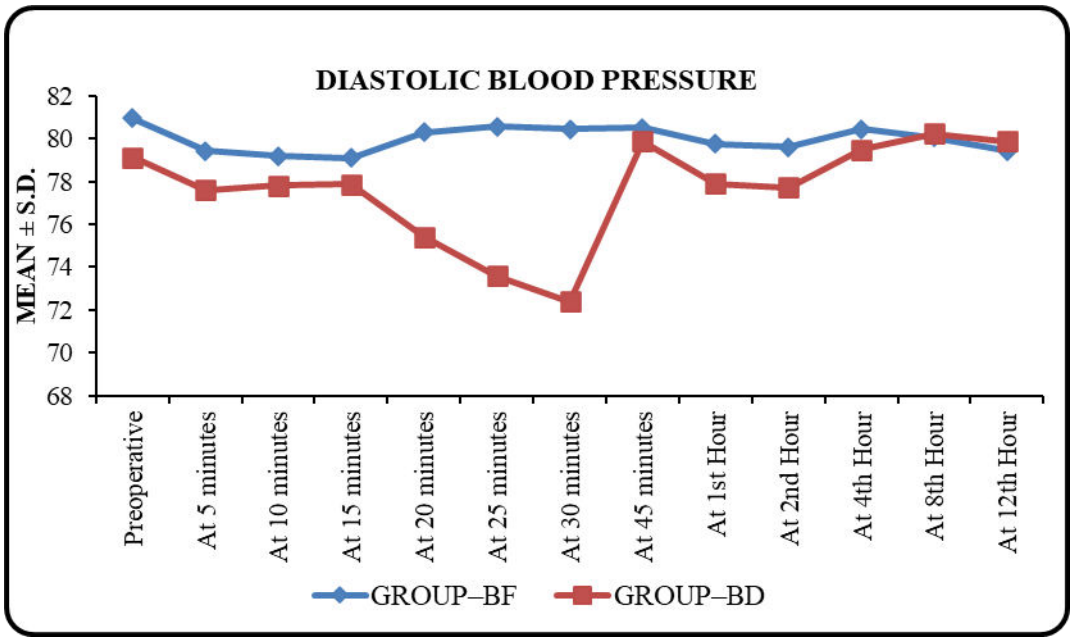

Figure-3

On measuring the mean blood pressure throughout the surgical procedure, the results showed significant difference between the two groups at 20 min, 25 min, and 30 min and also at 12th hour (p value < 0.001). None of the patient showed hypotension (< 20% of pre-operative value)atanytimeduringthestudy. (Table -5,Figure-4)

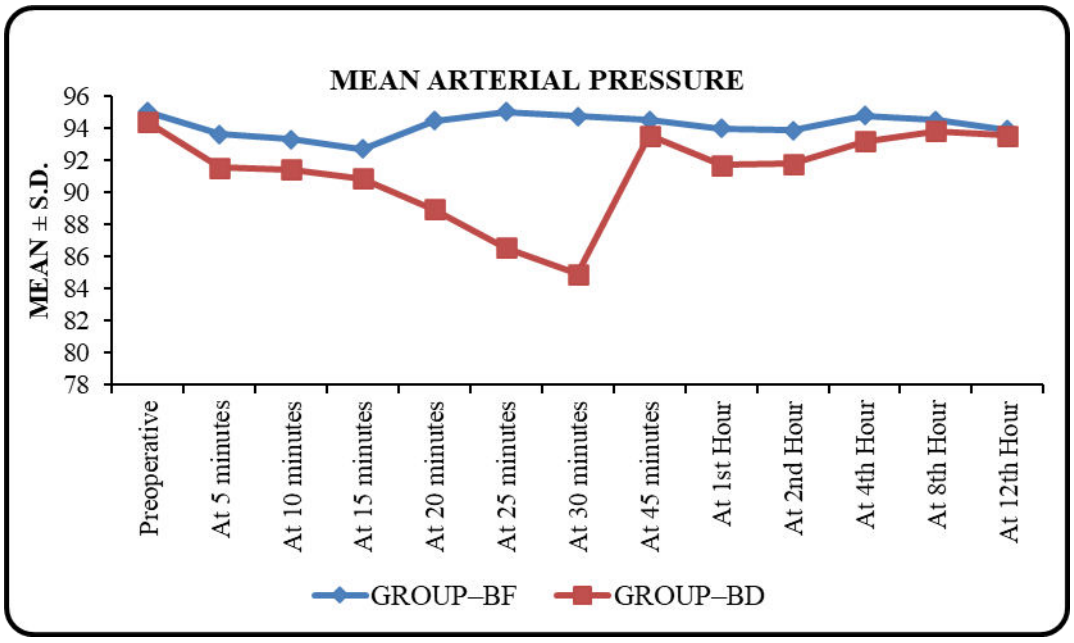

Figure-4

On measuring the SPO2 there was no significant difference between the two groups (p value >0.05) at any time in any patient during the study.

Assessment of sedation score done by Ramsay modified sedation score was recorded for each patient throughout the study and presented as percentage of number of patient in each group experiencing each scale. Patient in the BD group showed significant difference at 15 min to 1st hour.(Table-6)

The incidence of side effects was low and comparable in both the groups. Horner's syndrome was reported to be 5/35 (14.29%) in group BF and 6/35 (17.14%) in group BD, with a p value of 0.7426. Ipsilateral diaphragmatic palsy was reported in only one case in group BD and none in group BF with p value 0.313829. Hoarseness of voice due to recurrent laryngeal nerve palsy was seen in 9/35 (25.71%) in group BF and 8/35 (22.86%) in BD group, (p value = 0.78045). None of the patient had showed Local anaesthetic systemic toxicity in both the groups.(Table-7)

The quality of block was excellent in both the groups, each and every patient achieved successful block in both the groups. No patient had inadequate or failed block and none of the patient required general anaesthesia.

Table 1 – Demographic data

	Group BF (Mean ± SD)	**Group BD (Mean ± SD)**
Age (in years)	37.31 ± 8.44	37.94 ± 10.70
Weight (in kgs)	55.14 ± 5.26	53.46 ± 4.85
Duration of surgery (in minutes)	78.57 ± 27.73	83.54 26.21

Table 2 – Onset and duration of sensory & motor blockade& duration of Analgesia.

	GROUPS		**P-value**
	Group BF (Mean ± SD)	**Group BD (Mean ± SD)**	
Onset of Sensory Blockade (in minutes)	**9.84 ± 2.12**	**7.17 ± 1.32**	**<0.001**
Duration of sensory blockade (in minutes)	**465.20± 38.34**	**724.37± 43.36**	**<0.001**
Onset of motor blockade (in minutes)	**15.36± 2.99**	**10.77± 1.85**	**<0.001**
Duration of motor blockade (in Minutes)	**433.00± 37.64**	**682.43± 45.20**	**<0.001**
– Duration of analgesia.	**478.91±37.90**	**739.00 ±38.79**	**<0.001**

Table-3Comparision of Pulse Rate

TIME	GROUP–BF		GROUP–BD		*p value*
	Mean	*S.D.*	*Mean*	*S.D.*	
Preoperative	83.40	9.27	82.43	8.53	0.64967
At 5 minutes	78.83	9.17	76.60	8.73	0.30154
At 10 minutes	77.63	9.71	75.11	8.73	0.21873
At 15 minutes	75.34	8.20	73.29	7.09	0.26538
At 20 minutes	75.26	8.20	68.23	8.73	0.00066
At 25 minutes	75.77	8.88	66.23	8.96	<0.001
At 30 minutes	75.89	7.99	67.89	9.58	0.00032
At 45 minutes	79.00	8.50	74.89	6.62	0.00013
At 1st Hour	76.66	7.66	72.03	6.99	0.01026
At 2nd Hour	76.00	7.40	72.77	6.85	0.06249
At 4th Hour	77.11	7.45	74.03	7.07	0.08013
At 8th Hour	77.11	8.26	73.89	6.28	0.06988
At 12th Hour	77.26	9.32	74.89	6.62	0.22411

Table -4 Comparision of systolic blood pressure

TIME	GROUP–BF		GROUP–BD		*p value*
	Mean	*S.D.*	*Mean*	*S.D.*	
Preoperative	123.14	9.16	124.86	11.37	0.48962
At 5 minutes	121.97	6.03	119.37	8.71	0.15129
At 10 minutes	121.54	5.70	118.57	8.71	0.05402
At 15 minutes	119.83	7.33	116.74	7.64	0.08923
At 20 minutes	122.74	4.92	115.94	8.71	<0.001
At 25 minutes	123.94	6.18	112.46	8.49	<0.001
At 30 minutes	123.31	7.10	109.94	9.93	<0.001
At 45 minutes	122.46	6.91	120.80	7.21	<0.001
At 1st Hour	122.40	7.27	119.31	7.62	0.08768
At 2nd Hour	122.37	6.47	119.83	6.69	0.11076
At 4th Hour	123.37	6.68	120.57	6.22	0.07407
At 8th Hour	123.37	6.85	121.03	6.80	0.15556
At 12th Hour	121.89	6.38	120.80	7.21	0.50704

Table5-Comparision of Mean arterial Pressure

TIME	GROUP–BF		GROUP–BD		*p value*
	Mean	*S.D.*	*Mean*	*S.D.*	
Preoperative	95.03	5.50	94.38	7.54	0.68277
At 5 minutes	93.61	3.35	91.52	6.74	0.10553
At 10 minutes	93.31	3.02	91.41	6.74	0.06373
At 15 minutes	92.69	3.99	90.84	3.91	0.05441
At 20 minutes	94.44	3.08	88.93	6.74	<0.001
At 25 minutes	95.03	2.54	86.55	6.33	<0.001
At 30 minutes	94.74	4.11	84.91	7.50	<0.001
At 45 minutes	94.50	4.49	93.52	4.90	0.02048
At 1st Hour	93.98	3.76	91.71	5.28	0.03164
At 2nd Hour	93.86	3.25	91.77	4.62	0.38858
At 4th Hour	94.76	3.41	93.18	3.27	0.28459
At 8th Hour	94.50	3.92	93.83	3.82	0.36274
At 12th Hour	93.88	4.07	93.52	4.90	<0.001

Table—6 Comparision of sedation scores

TIME	GROUP–BF						GROUP–BD						*p value*
	SEDATION SCORE						SEDATION SCORE						
	1	2	3	4	5	6	1	2	3	4	5	6	
Preoperative	0	35	0	0	0	0	0	35	0	0	0	0	0.99202
At 5 minutes	0	35	0	0	0	0	0	35	0	0	0	0	0.99202
At 10 minutes	0	35	0	0	0	0	0	35	0	0	0	0	0.99202
At 15 minutes	0	35	0	0	0	0	0	9	26	0	0	0	<0.001
At 20 minutes	0	35	0	0	0	0	0	6	29	0	0	0	<0.001
At 25 minutes	0	11	24	0	0	0	0	1	16	18	0	0	<0.001
At 30 minutes	0	11	24	0	0	0	0	1	14	20	0	0	<0.001
At 45 minutes	0	35	0	0	0	0	0	3	29	3	0	0	<0.001
At 1st Hour	0	35	0	0	0	0	0	8	27	0	0	0	<0.001
At 2nd Hour	0	35	0	0	0	0	0	35	0	0	0	0	0.99202
At 4th Hour	0	35	0	0	0	0	0	35	0	0	0	0	0.99202
At 8th Hour	0	35	0	0	0	0	0	35	0	0	0	0	0.99202
At 12th Hour	0	35	0	0	0	0	0	35	0	0	0	0	0.99202

SIDE EFFECTS	GROUP–BF		GROUP–BD		*p value*
	n	%	*n*	%	
Horner's Syndrome	5	14.29	6	17.14	0.7426
Ipsilateral Diaphragmatic Palsy	0	0.00	1	2.86	0.313829
Hoarseness of Voice	9	25.71	8	22.86	0.78045
LA Toxicity	0	0.00	0	0.00	–

Table-7

DISCUSSION–

Interscalene brachial plexus block gives excellent anaesthesia and analgesia for surgeries. Interscalene brachial plexus block is used for providing anaesthesia and peri-operative pain management in surgery of shoulder joint like arthroscopy, acromioplasty, rotator cuff injury repair, fracture of humerus and elbow jointetc[2,3,4] To provide safe and effective pain relief prolonging the interscalene brachial plexus block is a better option with decreased incidence of side effects, with higher degree of patient satisfaction compared to patient controlled analgesia with opioid drugs.[15,16]Fentanyl on addition as adjuvant to peripheral nerve block enhances the action of local anaesthetic and the mechanism may be due to existence of peripheral function

opioid receptor. The prolongation of the effect of local anaesthetic is most probably by directly binding to opioid binding site in dorsal horn nerve root aided with axonal transports or diffusion into surrounding tissues and subsequently into epidural and subarachnoid spaces; it may be by central opioid receptor mediated action after systemic absorption of fentanyl.[17]Dexmedetomidine is a potent α2 agonist, and primarily analgesic effect is provided through α2 receptor activation in dorsal horn of spinal cord and inhibition of substance P release.[18] It acts on α2 receptor in the locus coerulus and dorsal horn of spinal cord and reduces central sympatholytic activity, which results in increased firing of inhibitory neurons and gives analgesic property. Inhibitory action on peripheral α2 receptor leading to hyperpolarisation of cell membrane, which decreases firing of excitable cells of CNS. Another mechanism proposed is that dexmedetomidine causes decrease in calcium conductance, which inhibit the release of neurotransmitter due to α2 receptor. Hence firing by nerve is prevented and also propagation of signal to the neighbouring cells, that is dexmedetomidine works in two different ways. Peripherally dexmedetomidine decrease nor-epinephrine release and inhibit action potential of nerve fibre by acting on α2 receptor.[18,19,20]In our study we divided 70 patients randomly into two groups- Group BF (received 15 mL of 0.5% bupivacaine + fentanyl 1μg/kg diluted with 0.9 % normal saline making 20 ml total volume) and Group BD (received 15 mL of 0.5% bupivacaine + dexmedetomidine 1μg/kg diluted with 0.9% normal saline making 20 ml total volume) with 35 patients in each group.

Demographic profiles (age, sex, weight, height), ASA status, types of surgery and duration of surgery were comparable and are statistically insignificant in both the groups.

ONSET OF SENSORY BLOCK

In our study we found the mean time for onset of sensory in group BF to be 9.84 ± 2.12 (min) and that of in group BD to be 7.17 ± 1.32 (min) which was highly significant statistically (p value <0.001) between the study group.

The mean time for onset of sensory block was shorter in dexmedetomidine group than in fentanyl group. These results are in concordance with a study by Safdari H et al [21], Swastika Swaro et al [12], Pratibha S Dharamao et al [22],, and Rahem M Hashim et al [23] showing early onset of sensory block in dexmedetomidine receiving group than in fentanyl group patients.

ONSET OF MOTOR BLOCK

In our study the mean time for onset of motor block was 15.36 ± 2.99 mins in fentanyl group (group BF) and it was 10.77 ± 1.85 mins in dexmedetomidine group (group BD). The result was highly significant (p value <0.001). The mean time for onset of motor block was faster in dexmedetomidine group than in fentanyl group.Result of our study was in accordance with the study done by, Safdari H et al, Swastika Swaro et, Pratibha S Dharmarao et al, and Rahem M Hashim et al(2019).However, study done by Soma C Cham et al [24] and, Nyla Farooq et al (2017), showed early onset of motor block in fentanyl group (3.06 ± 0.25, min and 14.1 ± 3.5 min, respectively) than in dexmedetomidine group (3.26 ± 0.45 min and 23.1 ± 3.9 min, respectively) which is not similar to our study.

DURATION OF SENSORY BLOCK

In the present study the mean duration of sensory block was observed to be 465.20 ± 38.34 min in fentanyl group and 724.37 ± 43.36 min in dexmedetomidine group. Our study showed longer duration of sensory block in dexmedetomidine group and it is highly significant p value <0.001.

Result of our study is similar with the study conducted by Safdari H et al, Swastika Swaro et al, Pratibha S Dharamao et al, and Rahem M Hashim et al. All these study shows prolong duration of sensory block in dexmedetomidine group than in fentanyl group.

DURATION OF MOTOR BLOCK

In our study we found the mean duration of motor block was longer in dexmedetomidine group (682.43 ± 45.20 min) than in fentanyl group (433 ± 37.64 min). We found highly significant difference group ($p<0.001$) in between both the groups.

In the similar studies conducted by Soma C Cham et al , Safdari H et al, Swastika Swaro et al, Pratibha S Dharamao et al, and Rahem M Hashim et al, found that addition of dexmedetomidine prolonged the duration of motor block compared to fentanyl to local anaesthetics and the result were highly significant statistically (p value<0.001) in all the studies.

DURATION OF ANALGESIA

In the present study, the mean duration of analgesia is carefully monitored to evaluate the efficacy of bupivacaine with dexmedetomidine (an α-2 agonist) and bupivacaine with fentanyl (a synthetic opioid) in providing post-operative pain relief in Interscalene Brachial Plexus Block.Mean duration of analgesia with dexmedetomidine group was 739 ± 38.79 min and that with fentanyl group was 478.91 ± 37.90 min, means analgesic duration was longer in dexmedetomidine group in comparison to fentanyl group which correlates well with Soma C Cham et al , Swastika Swaro et al , Nyla Farooq et al , Reham M Hashim et al .

HEMODYNAMIC PARAMETERS:

HEART RATE: In the present study the trend of mean heart rate remained lower than the mean baseline (pre-operative) value in all patient in all groups. However the trend of mean heart rate showed statistically significant difference between the two groups at 20 min, 25 min, 30 min, and 1 hour. The mean heart rate was found to be lower in dexmedetomidine group than in fentanyl group which is in accordance with other studies conducted by Nyla Farooq et al ,Rahim M Hashi[23]

SYSTOLIC BLOOD PRESSURE

The present study showed systolic blood pressure (SBP) lower than pre-operative value in all the patient in both the groups till regression of block after which it return to pre-operative value or near pre-operative value. It was observed that there was a significant decrease in SBP in patients of dexmedetomidine group at 20min, 25 min,30 min and 45 min which is statistically significant (p value <0.001) which was in accordance to other studies .

DIASTOLOC BLOOD PRESSURE

In this present study, the mean diastolic blood pressure (DBP) showed a significant difference at 20min, 25 min,30 min and 45 min (p value <0.001). The DBP ternd showed lower value in dexmedetomidine group at 20min, 25 min, 30 min and 45 min but had no statistically significant difference at any other time.

MEAN ARTERIAL BLOOD PRESSURE

The mean arterial blood pressure (MAP) in the present study showed lower value at 20min, 25 min, 30 min, 45 min and at 12th hour. This was statistically significant at these time (p value <0.001). This MAP was lower in dexmedetomidine group compared to fentanyl group. None of the patient showed hypotension at any time in both the group.

In a similar study, Soma C Cham et al, observed MAP lower than mean baseline (pre-operative) value in dexmedetomidine group, which was statistically significant from time interval of 30 min, but no fall <25% of MAP was observed in any patient in dexmedetomidine. While fluctuation of MAP in fentanyl group was insignificant. This result correlate with our present study.

In a study, Mohamed A Ham et al , the MAP after 10min, 20min, 30 min was lower in dexmedetomidine group compared to fentanyl group which was statistically significant (p value <0.001). Similarly low MAP in dexmedetomidine group was observed at 2 4, 5and 6 hour post-operatively, in comparison to fentanyl group.

SEDATION SCORE

In our present study sedation score was monitored using Ramsay sedation score (six score of sedation). The score was recorded for each patient throughout the study and presented as percentage of number of patient in each group experiencing each scale at 5 min, 10 min, 15 min, 20 min, 25 min, 30 min, 45 min, also at 1st hour, 2nd hour, 4th hour, 8th hour and 12th hour. There was significant difference noted after 15 min upto 45 minutes between both the groups. Patient who received fentanyl showed score 2 (awake, cooperative, oriented and tranquil) at each minute in each and every patient. But patients of dexmedetomidine group showed score of 2 in first 15 minutes after block administration in each and every patient. At 15 minutes 25.71429 % (9/35 patients) showed score 2, while 74.28571 % (26/35 patients) showed score of 3 (drowsy, with respond to command) sedation. At 20 min 17.14286 % (6/35 patients) showed score of 2, while 82.85714 % (29/35 patients) showed score of 3. At 25 min 2.857143 % (1/35 patients) showed score of 2, 45.71429 % (16/35 patients) showed score of 3, and 51.42857 % (18/35 patients) showed score of 4 (asleep, brisk response to glabellar tap or loud auditory stimulus). At 30 min, 2.857143 % (1/35 patients) showed score of 2, 40 % (14/35 patients) showed score of 3, 57.14286 % (20/35 patients) were in score of 4. At 45 min 8.571429 % (3/35 patients) patient showed score of 2, 82.85714 % (29/35 patients) were at score of 3, while 8.571429 % (3/35 patients) were in score of 4. At 1st hour 22.85174 % (1/35 patients) showed score of 2, and 77.14286 % (27/35 patients) patient were in score of 3. In a similar study on 45 patient in each group by Soma C Cham et al, sedation was monitored by RSS noted a sedation score of 3 in patients of dexmedetomidine group (17 patients) compared to fentanyl and control group, which was statistically significant which was in accordance with the present study.

In Safdari H et al, conducted study sedation scale measured by RSS at zero, one, two and three hour after intrathecal injection. The sedation score was significantly better in dexmedetomidine group in two and three hour compared to fentanyl and control group (p value <0.005) but not in zero and one hour (p value>0.005).

SIDE EFFECTS AND COMPLICATIONS

The present study reported minor side effects related to technique in very few patients of both the

groups. Horner's Syndrome (HS) was seen in 14.29 % (5/35) patient in group received fentanyl and 17.14 % (6/35) patients in group that received dexmedetomidine. Hoarseness of voice due to recurrent laryngeal nerve palsy was observed in 25.71 % (9/35) patient of fentanyl group, while in dexmedetomidine group it was 22.86 % (8/35) patients. Only one patient developed ipsilateral diaphragmatic palsy due to phrenic nerve block in patient of dexmedetomidine group which did not caused any interference with respiratory function and not required any management or intervention and resolved with time and with regression of effect of drug action. This small incidence of ipsilateral diaphragmatic palsy was most probably due to small volume of drug used (15 mL) or may be due to clinical diagnosis was taken rather than ultrasound diagnosis. But all these side effects were not significant statistically. Other major complication like inadvertent intra-vascular injection, spinal injection, epidural injection, external jugular vein puncture, pneumothorax, nerve injury, local anaesthetic systemic toxicity was not observed in any patient of both the group. Hypotension was reported in three patients of dexmedetomidine group. None had bradycardia in both the group, PONV was also not experienced in any patient of both the group. Sedation was reported in patient of dexmedetomidine which does not required any treatment or intervention and reversed with block regression.

In a similar study by AL-Kaisy A. A. et al (1998) studied the respiratory effects of low dose bupivacaine in interscalene block and concluded that 10 mL of 0.25% bupivacaine provided good upper limb block to C5-C6 dermatome with only occasional interference to respiratory function which was statistically insignificant which correlates with the present study.

QUALITY OF BLOCK

In the present study the quality of block was found to be excellent as no patient had inadequate block or failed block. None of the patients in both the group required additional supplementation of any analgesic or conversion to general anaesthesia.

CONCLUSION

From the present study of comparison of onset, duration of sensory and motor block with duration of analgesia between 0.5% Bupivacaine with fentanyl (1μg/kg) and 0.5% Bupivacaine with Dexmedetomidine (1μg/kg) in Interscalene brachial plexus block for shoulder surgery we conclude that Bupivacaine with Dexmedetomidine has faster onset of sensory and motor block with longer duration of sensory and motor block as well as duration of analgesia compared to Bupivacaine with Fentanyl. Hemodynamic changes were comparable among both the groups without any adverse effect and major complications.

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