Section: Anaesthesiology

Original Research Article

COMPARISON OF EFFICACY OF A COMBINATION OF 0.75% ROPIVACAINE AND FENTANYL & COMBINATION OF 0.75% ROPIVACAINE AND DEXMEDETOMIDINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES

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Abstract

Background: We want to compare the efficacy of 0.75% Ropivacaine and Fentanyl along with a combination of 0.75% ropivacaine and dexmedetomidine in supraclavicular brachial plexus block for forearm and hand surgeries. **Materials and Methods:** This was a hospital-based cantered, randomized prospective analytical study; conducted among patients who were admitted for undergoing upper limb surgeries under the Department of Anaesthesiology, Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH), Tirupati, Andhra Pradesh, from January 2022 to May 2023. **Result:** The mean age in the present study was 42.6 ± 13.94 years. The majority were aged between 40 – 59 years (43.9%). There was no significant difference in age between the subjects of D and F groups (p-value = 0.060). There was no significant difference in gender, body weight, diagnosis, and procedure of surgery between the subjects of D and F groups (p-values > 0.05).On comparing mean values of PR and MAP noted intra-operatively and postoperatively at 5 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 8 hours between groups, there was no statistically significant difference as p values were > 0.05. On comparing the mean values of the time of onset of Sensory and Motor Block between the groups, both were faster in Group D than in Group F with a p-value < 0.001. On comparing the mean values of time of duration of Sensory and Motor Block between the groups, both were prolonged in Group D than in Group F with p-value < 0.001. The mean first analgesic requirement time in Group D was 14.5 ± 1.09 hours which was delayed than in Group F (10.1 ± 0.80 hours) with p-value < 0.001. The mean VAS score at recovery in Group D subjects was 3.2 ± 0.36 and statistically significantly lower than the mean VAS scores at recovery in Group F subjects which was 4.2 ± 0.42 (p-value < 0.001). **Conclusion:** From the current study, it can be concluded that dexmedetomidine significantly provides a faster onset of sensory and motor block, and a longer duration of sensory and motor block as compared with fentanyl when used as an adjuvant with ropivacaine in supraclavicular brachial plexus block without any significant hemodynamic changes. Dexmedetomidine and fentanyl when used as additives to ropivacaine for brachial plexus block enhance the readiness for the surgery.

INTRODUCTION

Upper limb surgeries are generally performed under general anaesthesia but because of the increasing cost of anaesthetic agents, associated sequelae (nausea, vomiting, dry mouth, sore throat, hoarseness, shivering, dizziness, postoperative cognitive dysfunction, etc.), and due to problems of operation theatre pollution, the focus has now been shifted towards usage of regional anaesthesia.[1] Whenever the general condition of the patient is poor, or the patient is not adequately prepared or in the presence of associated conditions like uncontrolled diabetes, cardiovascular or respiratory diseases, or when the patient prefers to retain his consciousness during surgery and when a patient needs to remain

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ambulatory, the regional technique is always superior.[2] Regional anaesthesia has many advantages including excellent peri-operative analgesia, avoidance of airway instrumentation, avoidance of opioid-related side-effects, decreased recovery time, and improved patient satisfaction.[3] Brachial plexus block is achieved commonly via inter scalene, supraclavicular, infraclavicular, or axillary approach. Amongst all, the supraclavicular block is considered as "spinal of the arm" as it anaesthetises the entire arm just distal to the shoulder and is widely used for upper limb surgeries because of the anatomical ease of blocking nerve roots at this level. Brachial plexus block provides advantages over general anaesthesia like maintenance of general body physiology, decreased postoperative pain, shorter stay in the postoperative care unit, and decreased incidence of postoperative nausea and vomiting.[4]

Regional anaesthesia techniques have been limited mainly by 3 major factors local anaesthetic agent's slow onset time, short duration of action, and limited duration of postoperative analgesia. When local anaesthesia is used alone, they have a shorter duration of action. Short-acting and long-acting local anaesthetic have been combined to have a shorter onset of action and longer duration of action. Duration of analgesia with local anaesthesia can be prolonged by using indwelling catheters, but inherent problems with catheter placement are misplacement, migration, and infection.[5,6] Also, several adjuvants have been used with local anaesthetics during blocks which provide the benefits of prolonging the duration of action without the need for an additional procedure and risks of catheter insertion.[7] Alpha-2 agonists like clonidine, dexmedetomidine, opioids like fentanyl, and tramadol, and steroids like dexamethasone are used for the supraclavicular block to enhance the duration of analgesia and minimise the use of analgesics.[8-10]

Ropivacaine, an amide-linked local anaesthetic and an S (−) enantiomer, is less lipophilic than bupivacaine and hence has a decreased potential for cardiotoxicity and central nervous system (CNS) toxicity.[11-13] It is a long-acting amide with the greatest margin of safety among all local anaesthetics.[14] It has less penetration of large myelinated nerve fibers due to less lipophilicity, resulting in a greater degree of motor sensory differentiation. Conduction block with Ropivacaine in low doses displays greater sensory and motor separation and a lower incidence of serious adverse effects making it the preferred drug in its class for peripheral nerve blockade. Various studies have concluded that the addition of perineural dexmedetomidine to local anaesthetics significantly shortens the onset of sensory and motor block, prolongs the duration of analgesia, and prolongs time to the first analgesic request with minimal side effects.[12, 15-17. The addition of fentanyl to local anaesthetics enhances postoperative analgesia, but the duration was very brief 18.

Aims & Objectives

The study aimed to compare the efficacy of 0.75% Ropivacaine and Fentanyl along with a combination of 0.75% ropivacaine and dexmedetomidine in supraclavicular brachial plexus block for forearm and hand surgeries.

Objectives:

1. To estimate the time of onset of sensory and motor blockade with a combination of 0.75% ropivacaine and fentanyl
2. To estimate the time of onset of sensory and motor blockade with a combination of 0.75% ropivacaine and dexmedetomidine
3. To estimate the duration of sensory and motor blockade with a combination of 0.75% ropivacaine and fentanyl
4. To estimate the duration of sensory and motor blockade with a combination of 0.75% ropivacaine and dexmedetomidine
5. To compare the times of onset of sensory and motor blockade with a combination of 0.75% ropivacaine and fentanyl and a combination of 0.75% ropivacaine with dexmedetomidine
6. To compare the duration of sensory and motor blockade with a combination of 0.75% ropivacaine and fentanyl and a combination of 0.75% ropivacaine with dexmedetomidine
7. To compare the requirement of rescue analgesia in the combination of 0.75% ropivacaine and fentanyl and the combination of 0.75% ropivacaine with dexmedetomidine.

MATERIALS AND METHODS

Study Design: This study was an institution-based randomized prospective analytical study.

Study Population: The study population comprised of patients undergoing upper limb surgeries under the Department of Anaesthesiology, Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH), Tirupati, Andhra Pradesh.

Inclusion Criteria

- Patient presenting for anaesthesia for upper limb surgeries
- Age 18 to 60 years
- ASA physical status I and II

Exclusion Criteria

- Patient Refusal
- Patient with a history of bleeding disorders
- Patients continuing on anticoagulation therapy
- Patients with documented neurological and musculoskeletal disease
- Patient with known allergy to local anaesthetic drugs
- Psychiatric illness

Sampling Technique: A total number of 82 consecutive patients who were admitted for undergoing upper limb surgeries under the Department of Anaesthesiology, Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH), Tirupati, Andhra Pradesh was included.

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Method of Collection of Data and Methodology

- This was a hospital-based cantered, randomized prospective analytical study; conducted among patients who were admitted for undergoing upper limb surgeries under the Department of Anaesthesiology, Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH), Tirupati, Andhra Pradesh.
- The patients have explained the implications and outcome of a study in their language. They were explained that they were free to decide their participation in the study and that this would in no way affect the treatment process.
- Interventions: Two groups (n = 42 for each group) were formed by simple randomization.
- Group F: Received 25 ml volume of 0.75% ropivacaine and 1 ml Fentanyl.
- Group D: Received 25 ml volume of 0.75% ropivacaine and 1ml (50 microgram) of dexmedetomidine.

Study Methods

- After preop evaluation, written informed consent, and premeditations, the patient was shifted inside the operation theatre.
- Intravenous access using 18 G venflon was done and ringer lactate infusion was started.
- Preoperative heart rate, SpO2, blood pressure was noted.
- Randomization succession into one of the 2 groups was done prior to the beginning of research by computer-generated arbitrary number table and sealed opaque envelop technique. Neither the participant nor the observer was aware of the type of medications given to the participant.
- The person who performs the supraclavicular block, as well as monitoring, was blinded to the groups the patients belong to.

Methodology

- Patients in both groups were placed in the supine position.
- Group F and D received supraclavicular brachial plexus block using ultrasound guidance. After negative aspiration, 25 ml of 0.75% ropivacaine and fentanyl was delivered.
- Group D received a supraclavicular brachial plexus block using ultrasound guidance. After negative aspiration, 25 ml of 0.75% ropivacaine and 50 micrograms of dexmedetomidine were delivered.

The following parameters were observed following the block:

- Hemodynamic parameters: Pulse rate, non-invasive blood pressure, and oxygen saturation were monitored. Mean arterial blood pressure (MAP) pulse rate (PR), and oxygen saturation were recorded before application of the block as well as immediately after the block & 5 min intervals until 30 min & with 30 min intervals thereafter, until the end of the operation.
- Sensory block: Sensory block was tested with a 22-gauge hypodermic needle by using the pinprick test and was compared with the same stimulation in the contralateral hand. The sensory block was tested every 1 minute.
- Motor block: According to the modified Bromage scale for upper extremity
  - ❖ 0-able to raise the extended arm to 90 degrees for a full 2 seconds.
  - ❖ 1-able to flex the elbow and move the fingers but unable to raise the extended arm.
  - ❖ 2-unable to flex the elbow but able to move the fingers.
  - ❖ 3-unable to move arm, elbow, or fingers.

It was assessed at 1-minute intervals until a complete motor blockade occurred.

- Postoperatively pain scores were recorded by using visual analogue score between 0 to 10 (0-no pain,10= most severe pain)
- Rescue analgesia was given at VAS score of 4 or above

Operational Definitions

- Time to Onset of Sensory Block (minute): Time between the end of the last injection and the total abolition of the pinprick response, and complete paralysis in all sensations over the hand and forearm.
- Time to Onset of Motor Block (minute): Time taken from the injection of a drug to the development of complete motor block (Bromage score 3)
- Duration of the sensorial block (minute): Time interval between withdrawal of the needle and reappearance of paraesthesia in the 4 nerve distribution areas.
- Duration of motor block (minute): Time interval between the onset of motor block and the complete regression of motor block.
- First analgesic requirement time (minute): Rescue analgesia is defined as the time interval between block placement and the patient's first analgesic request.

RESULTS

[Table 1] shows the age distribution of the subjects where out of 82, 5 were aged < 20 years, 29 were between 20 and 39 years, 36 were aged 40 – 59 years and 12 were aged ≥ 60 years. The mean age in the present study was 42.6 ± 13.94 years. The majority were aged between 40 – 59 years (43.9%). There was no significant difference in age between the subjects of D and F groups (p-value = 0.060).

[Table 2] shows the distribution of subjects according to gender. 42 subjects were males while the rest 40 were female. There was no significant difference in parity between the subjects of D and F groups (p-value = 0.438).

[Table 3] shows the mean values of body weight (kg) among study subjects. On comparing the mean values of body weight between the groups, the mean body weight among the Group F subjects was higher (69.3 ± 8.35 kg) than when compared to the Group D subjects (66.9 ± 7.39 kg) with a p-value of 0.184 but

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this was not found to be statistically significant as p-value was > 0.05.

[Table 4] shows the diagnosis distribution of the subjects out of 82, 28 had humerus fracture, 52 had forearm fracture and 2 had other diagnosis. The majority had forearm fractures (63.4%). There was no significant difference in diagnosis between the subjects of D and F groups (p-value = 0.261).

[Table 5] shows the surgical procedure distribution of the subjects out of 82, 72 underwent ORIF, 4 underwent osteotomy, 4 underwent Closed Reduction K Wire and 2 underwent other surgical procedures. The majority underwent ORIF (87.8%). There was no significant difference in surgical procedure between the subjects of D and F groups (p-value = 0.390).

[Table 6] shows the distribution of subjects according to ASA status. 12 subjects were ASA I while the rest 70 were ASA II. There was no significant difference in parity between the subjects of D and F groups (p-value = 0.280).

[Table 7] shows the mean values of the time of onset of Sensory Block (Minutes) among study subjects. On comparing the mean values of the time of onset of Sensory Block (Minutes) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean time of onset of Sensory Block in Group D was 4.9 ± 0.84 minutes which was earlier than in Group F (10.6 ± 1.08 minutes) with p value < 0.001.

[Table 8] shows the mean values of the time of onset of Motor Block (Minutes) among study subjects. On comparing the mean values of the time of onset of Motor Block (Minutes) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean time of onset of Motor Block in Group D was 9.9 ± 1.06 minutes which was earlier than in Group F (15.2 ± 1.31 minutes) with p value < 0.001.

[Table 9] shows the mean values of the duration of Motor Block (Hours) among study subjects. On comparing the mean values of the duration of Motor Block (Hours) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean duration of Motor Block in Group D was 7.6 ± 0.54 hours which was more than in Group F (7.4 ± 0.73 hours) with p value < 0.001.

[Table 10] shows the mean values of the duration of Sensory Block (Hours) among study subjects. On comparing the mean values of the duration of Sensory Block (Hours) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean duration of the Sensory Block in Group D was 13.5 ± 1.28 hours which was more than in Group F (9.3 ± 0.87 hours) with p-value < 0.001.

[Table 11] shows the mean values of the first analgesic requirement time (Hours) among study subjects. On comparing the mean values of the first analgesic requirement time (Hours) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean first analgesic requirement time in Group D was 14.5 ± 1.09 hours which was delayed than in Group F (10.1 ± 0.80 hours) with p-value < 0.001.

[Table 12] shows the mean values of vitals noted preoperatively among study subjects. On comparing the mean values of vitals between groups, there was no statistically significant difference as p values were > 0.05.

[Table 13] shows the distribution of mean values of vitals noted intra-operatively and postoperatively among study subjects at 5 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 8 hours in both groups. Intra-operative vitals (PR, MAP, RR, and SpO2) were noted intra-operatively and postoperatively at 5 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 8 hours in both groups. The differences between mean vitals were compared statistically and were found to be statistically non-significant at all time intervals (all p-values> 0.05).

[Table 14] shows the mean values of VAS scores at recovery among study subjects. On comparing the mean values of VAS scores at recovery between the groups, there was a statistically significant difference as the p values were < 0.05.

The mean VAS score at recovery in Group D subjects was 3.2 ± 0.36 and statistically significantly lower than the mean VAS scores at recovery in Group F subjects which was 4.2 ± 0.42 (p-value < 0.001).

Table 1: Distribution of subjects according to age.

Age	Group D	Group F	Total
< 20 years	2 (4.9%)	3 (7.3%)	5 (6.1%)
20 – 39 years	12 (29.2%)	17 (41.5%)	29 (35.4%)
40 – 59 years	18 (43.9%)	18 (43.9%)	36 (43.9%)
≥ 60 years	9 (22%)	3 (7.3%)	12 (14.6%)
Total	41 (100%)	41 (100%)	82 (100%)
Mean (years)	46.5 ± 14.69	38.7 ± 12.09	42.6 ± 13.94
p-value	0.060		

Table 2: Distribution of subjects according to gender

Gender	Group D	Group F	Total
Males	24 (58.5%)	18 (43.9%)	42 (51.2%)
Females	17 (41.5%)	23 (56.1%)	40 (48.8%)
Total	41 (100%)	41 (100%)	82 (100%)
p-value	0.438		

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Table 3: Mean Body Weight (kg) Distribution among study subjects

Body Weight (kg)	Group D	Group F	Total
Range	54 - 82	49 - 81	49 - 82
Mean	66.9	69.3	68.1
SD	7.39	8.35	7.92
p-value	0.184		

Table 4: Distribution of subjects according to diagnosis

Diagnosis	Group D	Group F	Total
Humerus Fracture	17 (41.5%)	11 (26.8%)	28 (34.2%)
Forearm Fracture	23 (56.1%)	29 (70.7%)	52 (63.4%)
Others	1 (2.4%)	1 (2.4%)	2 (2.4%)
Total	41 (100%)	41 (100%)	82 (100%)
p-value	0.261		

Table 5: Distribution of subjects according to surgical procedure

Surgical Procedure	Group D	Group F	Total
ORIF	37 (90.3%)	35 (85.4%)	72 (87.8%)
Osteotomy	2 (4.9%)	2 (4.9%)	4 (4.9%)
Closed Reduction K Wire	1 (2.4%)	3 (7.3%)	4 (4.9%)
Others	1 (2.4%)	1 (2.4%)	2 (2.4%)
Total	41 (100%)	41 (100%)	82 (100%)
p-value	0.390		

Table 6: Distribution of subjects according to ASA status

ASA status	Group D	Group F	Total
ASA I	2 (4.9%)	10 (24.4%)	12 (14.6%)
ASA II	39 (95.1%)	31 (75.6%)	70 (85.4%)
Total	41 (100%)	41 (100%)	82 (100%)
p-value	0.280		

Table 7: Distribution of mean time of onset of Sensory Block (Minutes) among study subjects

Onset of Sensory Block (Minutes)	Group D	Group F	Total
Range	3.5 – 8.0	8.0 – 13.0	3.5 – 13.0
Mean	4.9	10.6	7.8
SD	0.84	1.08	3.00
p-value	< 0.001		

Table 8: Distribution of mean time of onset of Motor Block (Minutes) among study subjects

Onset of Motor Block (Minutes)	Group D	Group F	Total
Range	8.0 – 12.0	12.0 – 20.0	8.0 – 20.0
Mean	9.9	15.2	12.6
SD	1.06	1.31	2.96
p-value	< 0.001		

Table 9: Distribution of mean duration of Motor Block (Hours) among study subjects

Duration of Motor Block (Hours)	Group D	Group F	Total
Range	7.0 – 8.5	6.0 – 8.5	6.0 – 8.5
Mean	7.6	7.4	7.5
SD	0.54	0.73	0.65
p-value	< 0.001		

Table 10: Distribution of mean duration of Sensory Block (Hours) among study subjects

Duration of Sensory Block (Hours)	Group D	Group F	Total
Range	11.5 – 16.0	8.0 – 11.0	8.0 – 16.0
Mean	13.5	9.3	11.4
SD	1.28	0.87	2.36
p-value	< 0.001		

Table 11: Distribution of mean first analgesic requirement time (Hours) among study subjects

First analgesic requirement time (Hours)	Group D	Group F	Total
Range	13.0 – 16.0	9.0 – 11.0	9.0 – 16.0
Mean	14.5	10.1	12.3
SD	1.09	0.80	2.42
p-value	< 0.001		

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Table 12: Distribution of mean values of baseline vitals noted preoperatively among study subjects

Pulse rate (beats/minute)	Group D	Group F	Total
Range	54 - 96	55 - 96	54 - 96
Mean	74.6	71.4	73.0
SD	8.54	11.03	9.94
p-value	0.143		
Mean Arterial Pressure (mm of Hg)	Group D	Group F	Total
Range	62 - 87	62 - 94	62 - 94
Mean	77.9	77.7	77.8
SD	6.16	6.93	6.51
p-value	0.840		
Respiratory rate (breaths/minute)	Group I	Group II	Total
Range	12 - 18	14 - 16	12 - 18
Mean	15.3	15.5	15.4
SD	1.78	1.68	1.72
p-value	0.610		
SpO2 (%)	Group I	Group II	Total
Range	96 - 100	96 - 100	96 - 100
Mean	98.9	99.0	99.0
SD	1.21	1.24	1.22
p-value	0.857		

Table 13: Distribution of mean values of vitals noted intra-operatively and postoperatively among study subjects

Mean±SD	5 min	15 min	30 min	1 hr	2 hr	4 hr	6 hr	8 hr
Pulse rate (beats/minute)								
Group D	69.4 ± 6.95	66.1 ± 6.54	59.3 ± 4.99	57.4 ± 5.13	54.1 ± 4.58	51.7 ± 4.56	51.6 ± 4.40	53.6 ± 4.98
Group F	66.7 ± 10.33	64.0 ± 9.39	60.2 ± 7.29	58.8 ± 7.37	59.3 ± 7.10	59.6 ± 6.20	60.9 ± 7.21	74.3 ± 6.13
p-value	0.168	0.261	0.538	0.333	0.061	0.071	0.061	0.081
Mean Arterial Pressure (mm of Hg)								
Group D	75.3 ± 4.71	68.7 ± 4.53	70.5 ± 4.39	62.9 ± 4.38	65.9 ± 4.07	67.7 ± 4.78	65.8 ± 4.17	67.2 ± 4.07
Group F	74.5 ± 6.66	74.0 ± 5.80	71.0 ± 5.27	66.3 ± 5.05	71.0 ± 3.92	81.0 ± 4.03	80.9 ± 3.60	83.4 ± 3.92
p-value	0.517	0.051	0.683	0.092	0.081	0.096	0.082	0.071
Respiratory rate (breaths/minute)								
Group D	15.6±1.56	15.5±1.78	15.8±1.89	15.7±1.93	15.4±1.91	15.7±1.94	15.8±1.89	15.7±1.93
Group F	15.7±1.54	15.7±1.65	15.9±1.84	15.9±1.79	15.6±1.80	15.9±1.84	15.9±1.84	15.9±1.79
p-value	0.887	0.607	0.813	0.636	0.635	0.561	0.813	0.636
SpO2 (%)								
Group D	98.7 ± 1.71	98.8 ± 1.14	98.5 ± 1.03	98.6 ± 1.05	98.7 ± 1.11	98.6 ± 1.07	98.5 ± 1.03	98.6 ± 1.05
Group F	98.7 ± 1.19	98.9 ± 1.67	98.5 ± 1.02	98.7 ± 1.11	98.7 ± 1.41	98.7 ± 1.13	98.5 ± 1.02	98.7 ± 1.11
p-value	0.905	0.982	0.978	0.750	0.899	0.772	0.978	0.750

Table 14: Distribution of mean VAS scores at recovery among study subjects

VAS scores at recovery	Group D	Group F	Total
Range	3 - 4	4 - 5	3 - 5
Mean	3.2	4.2	3.7
SD	0.36	0.42	0.67
p-value	< 0.001		

DISCUSSION

Regional nerve blockade avoids unwanted effects of anesthetic drugs used in general anesthesia and is beneficial for patients with many cardiorespiratory comorbidities. In the supraclavicular approach, the plexus is blocked where it is most compactly arranged at the level of nerve trunks; as a result, a block with rapid onset can be achieved. Various adjuvants, including opioids, midazolam, magnesium sulfate, dexamethasone, and neostigmine, have been added to local anesthetics to increase the duration of block and postoperative analgesia.

Dexmedetomidine (α2 adrenoceptor agonist) is being used for IV sedation and analgesia for intubated and mechanically ventilated patients in ICUs. It has been reported to have a rapid onset time, to prolong the duration of local anesthetics, and it is approximately 8 times more potent than clonidine and is also reportedly safe and effective in peripheral nerve blocks. Opiates are known to have analgesic effects at the central and spinal cord levels. Opioid analgesia can be initiated by activation of peripheral opioid receptors. Opioids such as fentanyl have been used for regional nerve plexus blocks to improve the block duration and quality. The peripheral administration of fentanyl provides stronger and longer-lasting analgesia without central side effects.

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A total of 82 subjects were included in the study. Two groups (n = 42 for each group) were formed by simple randomization

- **Group D:** Received 25 ml volume of 0.75% ropivacaine and 1ml (50 microgram) of dexmedetomidine.
- **Group F:** Received 25 ml volume of 0.75% ropivacaine and 1 ml Fentanyl.

Baseline characteristics of the study participants:

Regarding the age distribution of the subjects, 5 were aged < 20 years, 29 were between 20 and 39 years, 36 were aged 40 – 59 years and 12 were aged ≥ 60 years. The mean age in the present study was 42.6 ± 13.94 years. The majority were aged between 40 – 59 years (43.9%). There was no significant difference in age between the subjects of D and F groups (p-value = 0.060).

Regarding gender, 42 subjects were males while the rest 40 were female. There was no significant difference in parity between the subjects of D and F groups (p-value = 0.438).

The study by Malin Debnath et al,[19] was a prospective, randomised clinical trial aimed to compare the onset and duration of sensory and motor blockade provided by dexmedetomidine and fentanyl as adjuvants to ropivacaine in such block. The demographic parameters such as age, and sex were comparable in the two groups. The mean age in Groups D and F were 36.23 ± 13.833 and 41.7 ± 11.481 years respectively and there was no significant difference of age and gender between the subjects of the groups (p-values = 0.101 and 0.436). These baseline characteristics regarding age and gender of the participants of this study were like those of the current study participants.

The study by M Umamaheshwar et al,[20] which was a randomised double-blinded clinical trial aimed to evaluate the block characteristics with the addition of either fentanyl or dexmedetomidine to 0.5% ropivacaine for a supraclavicular brachial block. There was no statistically significant difference (p-value >0.05) between the two groups concerning age and gender. The mean age in Group RD and RF were 35.0 ± 11.6 and 36.6 ± 11.6 years respectively and there was no significant difference in age and gender between the subjects of the groups (p-values = 0.647 and 0.345). These baseline characteristics regarding age and gender of the participants of this study were like those of the current study participants.

The study by Aavani Sanjeevan et al,[21] was a prospective observational, double-blinded study aimed to compare fentanyl and dexmedetomidine when added as an adjuvant to ropivacaine for Ultrasound-guided supraclavicular brachial plexus block. In group A, 38.46% of the individuals were females, while in group B, the proportion of females was 42.31%. Differences in age distribution and gender in groups A and B were not statistically significant (p-values = 0.879 and 0.777). These baseline characteristics regarding the age and gender of the participants of this study were similar to those of the current study participants.

The study by Saleena Beevi et al,[22] which was a hospital-based prospective comparative study aimed to evaluate the effects of fentanyl and dexmedetomidine as adjuvants to bupivacaine used for supraclavicular brachial plexus block in terms of analgesia, duration of motor block, and sensory and motor block onset times. Within the study group, the average age was 36.82 ± 12.18. The mean height among the study group was 166.26 ± 7.88. The mean weight was 65.27 ± 8.17. 40% of the study group consisted of females and 60% of males. No significant differences were noted regarding demographic data. These baseline characteristics regarding the age and gender of the participants of this study were similar to those of the current study participants.

The study by Pradeep Sahi et al,[23] which was a double-blind randomized prospective clinical trial aimed to evaluate the anaesthetic quality and duration of analgesia with the addition of either fentanyl or dexmedetomidine to ropivacaine 0.5% for brachial plexus block. There was statistically no significant difference between the groups concerning age and sex ratio. These baseline characteristics regarding the age and gender of the participants of this study were similar to those of the current study participants.

The study by Soma C. Cham et al,[24] which was a prospective clinical trial aimed to evaluate the anaesthetic quality and length of analgesia with the addition of either fentanyl or dexmedetomidine to ropivacaine for Supraclavicular brachial plexus block. There was statistically no significant difference between the groups concerning age and sex ratio. These baseline characteristics regarding the age and gender of the participants of this study were similar to those of the current study participants.

The study by Swaro et al,[25] which was a double-blinded randomized prospective clinical trial aimed to compare the sensory blockade, motor blockade, and duration of analgesia with the addition of fentanyl or dexmedetomidine to bupivacaine for supraclavicular brachial plexus block. Both groups were comparable in terms of age and gender. These baseline characteristics regarding the age and gender of the participants of this study were similar to those of the current study participants.

Analysis of confounding factors:

- **Body weight of the study participants:**

In this current study, on comparing the mean values of body weight between the groups, the mean body weight among the Group F subjects was higher (69.3 ± 8.35 kg) than when compared to the Group D subjects (66.9 ± 7.39 kg) with a p-value of 0.184 but this was not found to be statistically significant as p-value was > 0.05.

The study by Malin Debnath et al,[19] which was a prospective, randomised clinical trial showed that the weight was comparable in the two groups, and statistically not significant. The mean weight in Groups D and F were 65.23 ± 8.787 and 64.73 ±

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8.642 kgs respectively and there was no significant difference between the subjects of the groups (p-values = 0.825). These characteristics of the participants of this study were similar to that of the current study participants.

The study by Pradeep Sahi et al,[23] which was a double-blind randomized prospective clinical trial showed that there was statistically no significant difference between the groups concerning weight, and height. These characteristics of the participants of this study were similar to that of the current study participants.

The study by Soma C. Cham et al,[24] which was a prospective clinical trial showed that there was no statistically significant difference between the groups concerning weight. These characteristics of the participants of this study were similar to that of the current study participants.

The study by Swaro et al,[25] which was a double-blinded randomized prospective clinical trial showed that both groups were comparable in terms of weight (p=0.813). These characteristics of the participants of this study were similar to that of the current study participants.

- **Diagnosis of the study participants:**

In this current study, out of 82, 28 had humerus fractures, 52 had forearm fractures and 2 had another diagnosis. The majority had forearm fractures (63.4%). There was no significant difference in diagnosis between the subjects of D and F groups (p-value = 0.261).

- **Surgical procedure among study subjects:**

In this current study, out of 82, 72 underwent ORIF, 4 underwent osteotomy, 4 underwent Closed Reduction K Wire and 2 underwent other surgical procedures. The majority underwent ORIF (87.8%). There was no significant difference in surgical procedure between the subjects of D and F groups (p-value = 0.390).

The study by Soma C. Cham et al,[24] which was a prospective clinical trial showed that there was statistically no significant difference between the groups concerning the type of surgery. These characteristics of the participants of this study were similar to that of the current study participants.

The study by Swaro et al,[25] which was a double-blinded randomized prospective clinical trial showed that both groups were comparable in terms of type of surgery (p>0.001). These characteristics of the participants of this study were similar to that of the current study participants.

- **ASA status among study subjects:**

In this current study, 12 subjects were ASA I while the rest 70 were ASA II. There was no significant difference in parity between the subjects of the D and F groups (p-value = 0.280).

The study by Malin Debnath et al,[19] which was a prospective, randomised clinical trial showed that the demographic parameters such as ASA were comparable in the two groups (p-value = 0.196). These characteristics of the participants of this study were similar to that of the current study participants.

The study by Aavani Sanjeevan et al,[21] was a prospective observational, double-blinded study that showed that differences in ASA physical status distribution in groups A and B were not statistically significant (p-value = 0.773). These characteristics of the participants of this study were similar to that of the current study participants.

The study by Saleena Beevi et al,[22] which was a hospital-based prospective comparative study showed that the distribution of ASA PS classes 1 and 2 among the study group was 55% and 45% respectively, and was similar between the groups. These characteristics of the participants of this study were similar to that of the current study participants.

Vitals of the study participants:

This current study compares the mean values of vitals (PR, MAP, RR, and SpO2) preoperatively and the vitals noted intra-operatively and postoperatively at 5 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 6 hours, and 8 hours between groups, there was no statistically significant difference as p values were > 0.05.

The study by M Umamaheshwar et al,[20] which was a randomised double-blinded clinical trial showed that the trends in mean heart rate depict that they remained lower than mean baseline values in both groups. However, this difference in mean heart rates compared to respective preoperative mean baseline values was found to be statistically significant ($p<0.01$) in Group RD, it was statistically significant from 25 mins intervals onwards, however, none of the patients had bradycardia neither in Group RD nor Group RF. A mean MAP lower than the mean baseline MAP was observed in Group RD, there was no statistically significant difference in MAP up to 60 minutes from the time of administration of the block. However, the statistically significant (p-value <0.05) difference was seen from interval of 90 mins onwards. These characteristics of the participants of this study were not similar to that of the current study participants.

The study by Aavani Sanjeevan et al,[21] was a prospective observational, double-blinded study that showed that although, the use of dexmedetomidine as an adjuvant resulted in a greater decrease in HR and BP from baseline compared to fentanyl. By comparing heart rates between groups there was a statistically significant difference (p-value ≤0.05) in HR in 30, 45, 60, 90, 120, 150, 180, and 210 minutes. At the beginning of surgery, HR was comparable among groups. At 240 min, the heart again becomes comparable with p-value=0.868. By comparing SBP between groups there was a statistically significant difference (p-value ≤0.05) only at 210 minutes. At the beginning of surgery, SBP was comparable among groups. There was no significant difference between SBP during surgery. During the entire period of the study, DBP and oxygen saturation were comparable between groups and the difference was not statistically significant with (p-value ≤0.05). These characteristics of the participants of this study were similar to that of the current study participants.

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Comparison of time of onset of Sensory and Motor Block between the groups: In the current study, on comparing the mean values of time of onset of Sensory Block (Minutes) between the groups, there was statistically highly significant difference as the p-value was < 0.05. The mean time of onset of Sensory Block in Group D was 4.9 ± 0.84 minutes which was earlier than in Group F (10.6 ± 1.08 minutes) with p value < 0.001.

On comparing the mean values of the time of onset of Motor Block (Minutes) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean time of onset of Motor Block in Group D was 9.9 ± 1.06 minutes which was earlier than in Group F (15.2 ± 1.31 minutes) with p value < 0.001.

The study by Aavani Sanjeevan et al,[21] was a prospective observational, double-blinded study that showed that the onset of sensory block and meantime for the onset of sensory block were early in group B compared with group A, but statistically not significant with a p-value of 0.785 and 0.690, respectively. The mean time for the onset of sensory block was seven minutes prolonged in group A compared to group B. The onset of motor block and mean time to complete motor blockade were early in group B compared with group A but statistically not significant with a p-value more than 0.05. These characteristics of the participants of this study were not similar to that of the current study participants.

The study by Saleena Beevi et al,[22] which was a hospital-based prospective comparative study showed that Group B observed a mean onset time of 10.03 ± 1.25 min, with a p-value of < 0.001, while Group A experienced a quicker 6.43 ± 1.22 min. Hence, the two groups were statistically significant. Group A had a faster mean time to motor block onset of 9.7 ± 0.95 min, whereas group B had a mean time of 12.93 ± 1.82 min, with a p-value of < 0.001. Therefore, there was a statistically significant difference. These characteristics of the participants of this study were similar to that of the current study participants.

The study by Soma C. Cham et al,[24] which was a prospective clinical trial showed that the onset of sensory analgesia and motor blockade was quicker in patients receiving either fentanyl or dexmedetomidine as an adjuvant, the difference being statistically significant. A complete sensory block, as well as a complete motor block, was achieved in a shorter duration in all the patients of Group RD and Group RF compared to the patients in Group R. These characteristics of the participants of this study were similar to that of the current study participants.

Comparison of time of duration of Sensory and Motor Block between the groups: In the current study, on comparing the mean values of duration of Motor Block (Hours) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean duration of Motor Block in Group D was 7.6 ± 0.54 hours which was more than in Group F (7.4 ± 0.73 hours) with p value < 0.001.

On comparing the mean values of the duration of Sensory Block (Hours) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean duration of the Sensory Block in Group D was 13.5 ± 1.28 hours which was more than in Group F (9.3 ± 0.87 hours) with p value < 0.001.

The study by Malin Debnath et al,[19] which was a prospective, randomised clinical trial showed that the duration of sensory block was higher in group A (826±58.27) as compared to group B (592±51.62) and the duration of motor block was also higher in group A (682±62.001) as compared to group B (462±57.14). These differences in the duration of sensory and motor block were found statistically highly significant (P value is <0.01). These characteristics of the participants of this study were similar to that of the current study participants.

The study by M Umamaheshwar et al,[20] which was a randomised double-blinded clinical trial showed that the duration of sensory and motor block was significantly longer in Group RD compared to Group RF. These characteristics of the participants of this study were similar to that of the current study participants.

The study by Soma C. Cham et al,[24] which was a prospective clinical trial showed that the total duration of sensory block was significantly prolonged by almost 1½ hr in Group RD compared to Group R. Prolongation was also observed in Group RF, however, less than that observed in Group RD. Motor block also took a significantly longer time to regress in Group RD compared to both Group RF and Group R. These characteristics of the participants of this study were similar to those of the current study participants.

Comparison of first analgesic requirement time (Hours) among study subjects:

- In the current study, on comparing the mean values of the first analgesic requirement time (Hours) between the groups, there was a statistically highly significant difference as the p-value was < 0.05. The mean first analgesic requirement time in Group D was 14.5 ± 1.09 hours which was delayed than in Group F (10.1 ± 0.80 hours) with p-value < 0.001.
- The study by M Umamaheshwar et al,[20] which was a randomised double-blinded clinical trial showed that a total of four patients in group RF requested rescue analgesia at 6 hrs and their VAS scores were high even after the first rescue analgesia was given. These characteristics of the participants of this study were similar to that of the current study participants.
- The study by Aavani Sanjeevan et al,[21] was a prospective observational, double-blinded study that showed that the mean duration of analgesia in group A was 107 minutes higher than group B. All the above differences were statistically significant with a p-value <0.001. These characteristics of the

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participants of this study were similar to that of the current study participants.

- The study by Saleena Beevi et al,[22] which was a hospital-based prospective comparative study showed that the mean duration of analgesia in group A was 734 ± 34.4 min, which was longer and group B was 650 ± 23.34 min, while was found to be shorter with a p-value of < 0.001. Hence, the difference was statistically significant. These characteristics of the participants of this study were similar to that of the current study participants.

Comparison of VAS scores at recovery between the groups:

In the current study, the mean VAS score at recovery in Group D subjects was 3.2 ± 0.36 and statistically significantly lower than the mean VAS scores at recovery in Group F subjects which was 4.2 ± 0.42 (p-value < 0.001).

The study by M Umamaheshwar et al,[20] which was a randomised double-blinded clinical trial showed that the requirement for rescue analgesia was also lesser in Group RD since the mean VAS score was persistently low i.e. 0.2±0.58 at 10 hrs and 4.36±0.76 at 12 hrs which was statistically significant (p-value <0.01) compared to Group RF where the mean VAS score was 4.08±1.12 at 10 hrs and 4.88±0.44 at 12 hrs. These characteristics of the participants of this study were similar to that of the current study participants.

CONCLUSION

The supraclavicular block is a reliable and rapid onset method of brachial plexus block for anaesthesia of the upper limb. Dexmedetomidine is a better adjuvant to ropivacaine in Ultrasound-guided supraclavicular brachial plexus block in terms of duration of sensory block, motor block, and analgesia compared to fentanyl. Dexmedetomidine appears to be a promising drug for a supraclavicular block in upper limb surgeries. From the current study, it can be concluded that dexmedetomidine significantly provides a faster onset of sensory and motor block, and a longer duration of sensory and motor block as compared with fentanyl when used as an adjuvant with ropivacaine in supraclavicular brachial plexus block without any significant hemodynamic changes. Dexmedetomidine and fentanyl when used as additives to ropivacaine for brachial plexus block enhance the readiness for the surgery.

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