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Comparative Study of Intraoperative and Postoperative Analgesia of Supraclavicular Block in Upper Limb Surgeries

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ABSTRACT
To study the onset and duration of sensory and motor block and to compare intra operative quality of anaesthesia. A prospective comparetive interventional study was conducted on 60 patients posted for upper limb surgeries in orthopaedics and surgery admitted at Basaveshwara teaching and general hospital attached to Mahadevappa Rampure medical college Kalburgi, NOV 2019-April 2021. There was statistically not significant difference found in distribution of study subjects according to drug used and gender. (p>0.05). There was statistically highly significant difference found in mean Time of onset of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00) There was statistically highly significant difference found in mean duration of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00). There was statistically highly significant difference found in mean Time of onset of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00). It is great for procedures of the arm, forearm and hand. Ropivacaine is a less cardio toxic, neuro toxic local anaesthetic and equally potent with Bupivacaine in peripheral nerve blockade.

INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage[1]. In the ancient days alcohol, opium, hashish were used to reduce the pain.

In 1884, William Halsted, a surgeon from john Hopkins institute, performed the first brachial plexus nerve block when he found the cords and nerves of the brachial plexus, after blocking the roots in the neck with cocaine solution 0.1% under direct vision[2].

In January 1900, Harvey William Cushing (1869-1939), an American neurosurgeon, during his residency training, applied cocaine to the brachial plexus prior to dividing it, during a forequarter amputation for sarcoma[3].

The first percutaneous supraclavicular block was performed in 1911 by German surgeon Diedrich Kulenkampff (1880-1967)[4]. Kulenkampff subjected himself to the supraclavicular block, by 10 ml of procaine, in what is known as classical approach.4 Subsequently, studies showed a high incidence of pneumothorax (2-6%) with this approach and modifications of supraclavicular technique have been developed in an effort to decrease incidence of pneumothorax.

George Hirschel (1875-1963) later in the same year, described a percutaneous approach to the brachial plexus from the axilla[5]. He made separate injections above and below the axillary artery with a four inch needle directed towards apex of axilla.

In 1928, Diedrich Kulenkampff and Persky published their experiences with a thousand blocks without apparent major complications[6]. They described their technique with the patient in the sitting position or in the supine position with a pillow between the shoulders. The needle was inserted above the midpoint of the clavicle where the pulse of the subclavian artery could be felt and it was directed medially towards the second or third thoracic spinous process.

The subclavian (Supraclavicular) perivascular technique was first developed by Willie and Collins in 1964, with a reported incidence of pneumothorax less than 1%.

MATERIALS AND METHODS

A prospective comparetive interventional study was conducted on 60 patients posted for upper limb surgeries in orthopaedics and surgery admitted at Basaveshwara teaching and general hospital attached to Mahadevappa Rampure medical college Kalburgi, NOV 2019-April 2021

Inclusion Criteria:

- ASA grade I or II of either sex.
- Ages between 18-60 years of either sex.
- Patients undergoing elective upper limb surgeries.

Exclusion Criteria:

- Parents/Guardian refusal or not giving consent.
- Patients with Neurological disease.
- Local skin infections or disease.
- Patients with bleeding diathesis.
- History of drug allergy to bupivacaine, Ropivacaine and Fentanyl.
- Coagulopathy.
- Sever liver or kidney diseases.

Preanaesthetic Evaluation:

- All the patients were subjected to detailed pre-anaesthetic evaluation with clinical history, thorough physical and systemic examination, routine investigation which include complete blood count, urine (routine and microscopy), blood sugar, renal function test, serum electrolytes, X-ray chest PA view, ECG and any special investigation if required was done for the study. An informed written consent was taken from all the patients after explaining every patient in detail regarding nature and purpose of the study and also for the possible risks and complications.

Equipments:

- For the procedure.
- Portable tray covered with sterile towels containing-Sterile syringes-20ml, 10ml and 5 ml.
- Hypodermic needles of 5 cm length, 22 G.
- Inj. Bupivacaine 0.5% vial.
- Inj. Ropivacaine ampoule 0.5%.
- Inj. fentanyl ampoule.
- Bowl containing Povidone iodine and spirit.
- Sponge holding forceps.
- Towels and towel clips.
- Sterile guaze pieces.

For Emergency Resuscitation:

- The anaesthesia machine, emergency oxygen source (E type cylinders) pipeline O2 supply, working laryngoscopes, appropriate size endotracheal tubes, LMA and connectors.
- Working suction apparatus with suction catheter.
- Oropharyngeal airways.
- Intravenous fluids.
- **Drugs:** Thiopentone, Diazepam, Succinylcholine, Hydrocortisone, Atropine, Adrenaline, Aminophylline, Mephenteramine, Calcium gluconate and Sodium bicarbonate.

Monitors:

- Pulse oximeter
- Non invasive blood pressure
- ECG

Procedure: Intravenous access obtained in the limb opposite to that undergoing surgery in the preoperative area, with a large bore i.v cannula. Patient then shifted to the operation theatre. Standard multiparameter monitors, ECG, Pulse oximeter, non invasive blood pressure were connected and monitored in all the patients and recorded at interval of 5 minute in the first 30 minutes and every 30 minutes thereafter.

- Patient lies supine, arms by the side and head turned slightly to the other side.
- The interscalene groove and mid-point of clavicle identified.
- After aseptic painting of area, at a point 1.5 to 2.0cm posterior and cephalad to mid point of clavicle, subclavian artery pulsations are felt. A skin wheel is raised with local anaesthetic just cephalo-posterior to the pulsations.
- Next, a 22 gauge, 5cm needle, connected on a 20ml syringe, passed through the same point, parallel to the head and neck, in a caudad, slightly medial and posterior direction, until either paraesthesia was elicited or first rib was encountered.
- If the first rib is encountered, the needle was moved over the first rib until a paraesthesia was elicited either in the hand or arm.
- After eliciting paraesthesia and negative aspiration of blood, the study medication was injected.
- All patients monitored for vitals, Spo2, analgesia any adverse effects for up to 24 hours post-operatively.

Assessment of Sensory Block: Sensory block was assessed by pin prick with 23g hypodermic needle in skin dermatomes c4-t2 once in every minute for initial 30 minutes and then after every 30 minutes till patient regained normal sensations and graded according to Visual analogue scale (VAS).

Assessment of Motor Block:
Motor blockade was assessed by a 3 point motor score as described by bromage.
Grade 0-full flexion and full extension of elbow, wrist and fingers.
Grade 1-Ability to move fingers only.
Grade 2-Inability to move fingers.
The effect on the following parameters were observed.

Onset Time of Motor Blockade: Taken from the completion of injection of study drug to the time when a complete inability to move fingers. (score-2)

Onset Time of Sensory Blockade: Taken from the completion of injection of study drug till the patient does not feel the pin prick.(Visual analogue scale score-0).

Duration of Motor Blockade: Taken from the motor blockade till the restoration of full flexion and extension of elbow, wrist and fingers.(score-0).

Duration of Sensory Blockade: Taken from the onset of sensory blockade till the patient feels pin prick. (visual analogue scale of 2).

Duration of Analgesia: Taken as the time between the onset of sensory blockade and onset of pain. It was the time when patient received first dose of analgesic.
It was assessed by visual analogue scale (VAS) which consisted of a 10 cm scale with gradations marked as '0' means no pain and '10' means worst pain. Patients were asked to rate the degree of pain by making a mark on the scale. Thus the score was obtained by measuring the distance from the '0' end to the indicated mark.

10	9	8	7	6	5	4	3	2	1	0
Worst pain		Severe pain		Uncomfortable pain			Mild pain		No pain	

RESULTS AND DISCUSSIONS

Table 1: Comparison of Age wise Distribution of Patients in Both the Groups.

	Group		Total	p-value
Age cat	Group D	Group F		Chi square
21 to 30	4(13.33%)	10(33.33%)	14(23.33%)	
31 to 40	11(36.67%)	8(26.67%)	19(31.67%)	0.277
41 to 50	8(26.67%)	8(26.67%)	16(26.67%)	
51 to 60	7(23.33%)	4(13.33%)	11(18.33%)	
Total	30(100%)	30(100%)	60(100%)	

Table 2: Comparison of Mean Age of Patients in Both the Groups.

Variable(n1/n2)	Group D	Group F	p-value- Student t test
Age	42.4(±9.65)	37.67(±10.79)	0.08

Table 1/Fig. 1/Table 2 reveals demographic distribution of study subjects according to drug used and age. Total 60 patients were selected for the study. Out of 60 patients, randomly 30 were given Bupivacaine with Fentanyl and 30 were given Ropivacaine with Fentanyl. Out of 60 patients, in group D, 4 patients were of age group 21-30, 11 of age group 31-40, 8 of age group 41-50, 7 of age group 51-60. In group F, 10 people of age 21-30, 8 of age 31-40, 8 of age 41-50, 4of age 51-60. There was statistically not significant difference found in distribution of study subjects according to drug used and gender. (p>0.05).

Table 3: Comparison of Gender wise Distribution in Both the Groups.

	Group		Total	p-value
Sex	Group D	Group F		Chi square
Female	6(20%)	12(40%)	18(30%)	0.09
Male	24(80%)	18(60%)	42(70%)	
Total	30(100%)	30(100%)	60(100%)	

Table 3/fig. 2. reveals demographic distribution of study subjects according to drug used and gender. Total 60 patients were selected for the study. Out of 60 patients, randomly 30 were given Bupivacaine with Fentanyl and 30 were given Ropivacaine with Fentanyl. Out of 60 patients, 6 were female and 24 were male in

group D and 12 female and 18 in group F. There was statistically not significant difference found in distribution of study subjects according to drug used and gender. (p>0.05).

Table 4: Comparison of ASA Grade in Both the Groups

	Group		Total	p-value
ASA	Group D	Group F		Fisher's Exact
1	27(90%)	25(83.33%)	52(86.67%)	0.706
2	3(10%)	5(16.67%)	8(13.33%)	
Total	30(100%)	30(100%)	60(100%)	

Table 4 /fig. 3 reveals demographic distribution of study subjects according to drug used and ASA GRADE. Total 60 patients were selected for the study. Out of 60 patients, randomly 30 were given Bupivacaine with Fentanyl and 30 were given Ropivacaine with Fentanyl. Out of 60 patients, 27 Patients were of ASA-I and 3 patients were of ASA-II in group D. 25 Patients of ASA I and 5 patient of ASA II in group F. There was statistically not significant difference found in distribution of study subjects according to drug used and gender. (p>0.05).

Table 5: Comparative Evaluation of Mean Time of Onset of Sensory Block Between Bupivacaine with Fentany (Group D) and Ropivacaine with Fentanyl (Group F) among Study Subjects.

Variable	Group D	Group F	p-value-Student t test
Time of onset of sensory blockade (MIN)	9.67(±1.56)	7.3(±1.51)	0.00

Table no 5 /fig no 4: reveals comparative evaluation of mean Time of onset of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. Mean Time of onset of sensory block was more among group D patients as compare to group F patients. It was 9.67 minute in group D and 7.30 in group F patients respectively. There was statistically highly significant difference found in mean Time of onset of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00)

Table 6: Comparative Evaluation of Mean Duration of Sensory Block Between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects.

Variable	Group D	Group F	p-value-Student t test
Duration of sensory blockade	658.73(±47.7)	574.33(±24.73	0.00

Table 6/fig. 5 reveals comparative evaluation of mean duration of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. Mean duration of sensory block was more among group D patients as compare to group F patients. It was 658.73 minute in group D 574.33 in group F patients respectively. There was statistically highly significant difference found in mean duration of sensory block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00)

Table7: Comparative Evaluation of Mean Time of Onset of Motor Block Between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among Study Subjects.

Variable	Group D	Group F	p-value-Student t test
Time of onset of motor blockade (MIN)	15.8(±1.9)	11.3(±1.39)	0.00

Table 7/fig. 6 reveals comparative evaluation of mean Time of onset of motor block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. Mean Time of onset of motor block was more among group D patients as compare to group F patients. It was 15.80 minute in group D and 11.30 minutes in group F patients respectively. There was statistically highly significant difference found in mean Time of onset of motor block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00)

Table 8: Comparative Evaluation of Mean Duration of Motor Block Between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among Study Subjects.

Variable	Group D	Group F	p-value-Student t test
Duration of Motor blockade	439.33(±48.77)	368.67(±24.74)	0.00

Table 8 /fig. 7: reveals comparative evaluation of mean duration of motor block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. Mean duration of motor block was more among group D patients as compare to group F patients. It was 439.33minute in group D and 368.67 in group F patients respectively. There was statistically highly significant difference found in mean duration of motor block between Bupivacaine with Fentanyl and Ropivacaine with Fentanyl among study subjects. (P=0.00)

In our study, there was delayed onset of sensory and motor block on addition of fentanyl to bupivacaine., it could be due to change in pH of anesthetic solution. Similar to this study, other studies also concluded that duration of analgesia is prolonged by addition of fentanyl to bupivacaine.

A comparative study conducted by Gohiya Sarita and Gohiya Vineet. (A Comparative study of efficacy of fentanyl added to Bupivacaine versus Bupivacaine alone used in supraclavicular brachial block for upper limb surgeries). On statistical analysis, results showed that onset of sensory block was significantly prolonged on addition of Fentanyl to Bupivacaine. There was no adverse effect observed on addition of Fentanyl and Hemodynamic variables are also not significantly affected[8].

In a study conducted by Anupreet kaur[22] a prospective randomized study in 50 patients between 18-55 year, comparable in demographic variables, were randomly allocated to two groups of 25 each. Group I received 30ml 0.5% Bupivacaine, Group II received 30 ml 0.5% Ropivacaine in axillary brachial plexus block for forearm surgeries. Onset, Duration of

sensory-motor block, Heart rate, Blood pressure, Oxygen saturation and Respiratory rate were recorded. On the basis of their study, they concluded that onset of action of sensory, motor block was early in Ropivacaine group with faster recovery of motor functions as compared to Bupivacaine group.

According to Suvarna Kaniyil, Priya Radhakrishnan[9]. (Does fentanyl prolong the analgesia of local anaesthetics in brachial plexus block? A randomized controlled study), Addition of fentanyl to local anesthetics in brachial plexus block significantly prolonged the duration of analgesia without any significant side effects though it had delayed the onset of block.

In a study conducted by Tejwant Rajkhowa[10] The addition of fentanyl to ropivacaine significantly prolonged the duration of analgesia compared to ropivacaine used alone for supraclavicular brachial plexus blocks in patients undergoing forearm surgeries.

CONCLUSION

The brachial plexus block via the supraclavicular approach instinctively is associated with brisk onset of anaesthesia and highly successful. It is great for procedures of the arm, forearm and hand. Ropivacaine is a less cardio toxic, neuro toxic local anaesthetic and equally potent with Bupivacaine in peripheral nerve blockade.

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