RESEARCH PAPER

ULTRASOUND GUIDED SUPRACLAVICULAR VERSUS INFRACLAVICULAR (PARACORACOID) BRACHIAL PLEXUS BLOCK FOR ELECTIVE UPPER LIMB SURGERIES

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ABSTRACT:
The study entitled "ULTRASOUND GUIDED SUPRACLAVICULAR VERSUS INFRACLAVICULAR(PARACORACOID) BRACHIAL PLEXUS BLOCK FOR UPPER LIMB SURGERIES" was conducted in department of Anaesthesiology at Narendra Modi medical College, L. G. Hospital, Ahmedabad ,on sixty adult patients of ASA grade I and II , posted for elective upper limb surgeries.
Patients were randomly divided by consultant into 2 groups, GROUP 1 and GROUP 2 at time of giving block, by odd & even numbers put in opaque sealed envelope. In both groups US guided block given by Inj Bupivacaine 0.5%,20 ml& dexamethasone 4 mg (1ml) by supraclavicular/ Infra-clavicular (Paracoracoid approach).
Results: scaning & Needling time were more in infraclavicular block but sensory & motor block was prolonged in infraclavicular block,
Keywords: Brachial plexus block, infraclavicular block, Paracoracoid approach, supraclavicular block, upper limb surgeries
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Introduction

Ultrasound guided regional anaesthesia is method of choice as it provides perioperative analgesia, good muscle relaxation during surgery, greater hemodynamic stability, prolongs duration to first dose of opioid consumption postoperatively & lessens the duration of hospital stay(1)
Ultrasound guided regional anaesthesia has developed on anatomical superficiality of brachial plexus and which makes it favourable technique for anaesthesia in upper limb surgery, and development in upper limb regional anaesthesia were active until arrival of ultrasound.[2]
The supraclavicular brachial plexus block targets the plexus where it is most compact behind the clavicle, providing reliable anaesthesia of the entire upper limb with a small volume of local anaesthetic—hence the name "spinal of the arm." Although widely used, its popularity declined due to pneumothorax risk, and later alternative periclavicular techniques did not gain widespread acceptance. [2]
The Infra-clavicular brachial plexus block provides anesthesia for the hand, forearm, elbow, and distal humerus. It is ideal for catheter placement due to secure support from the chest wall muscles. [3]
In Ultrasound guided Para coracoid (conventional approach) group,enables effective anaesthesia with a single low volume injection, carries a low risk of vascular injury or pleural puncture.[3]
Both ultrasound-guided supraclavicular and infra clavicular brachial plexus blocks allow a single needle puncture with local anesthetic deposited at one site lateral to the artery. However, as few studies directly compare these techniques, we conducted this study to evaluate and compare their efficacy.

Aims & Objectives

The Study aims to compare both routes of brachial plexus blocks for elective Surgeries of upper limb by using ultrasound guidance.The objectives of our study were to compare -

PRIMARY OBJECTIVE:

To compare the block efficacy based on:

1. sensory and motor characteristics
2. Block performance time
3. Success rate

SECONDARY OBJECTIIVES:

To compare
Sparing of Nerve and occurrence of complications.

Methods : After obtaining IRB approval study was carried out on sixty adult patients of ASA grade l and ll for various upper limb surgeries. Study was conducted at Tertiary care hospital during the year of 2024-2026.

SAMPLE SIZE CALCULATION: -

The sample size was calculated on a result of our pilot study of 5 patients in each group ,having a mean time of block of 17(±9)mins and 10(± 7)mins, supraclavicular & Infra-clavicular block respectively, With a 95% confidence interval (CI), 10% non-response and 80% power, and 1:1 allocation, we got a sample population of 30 in each group, of total 60 participants.

INCLUSION CRITERIA:

- Adult patients
- ASA Grade I, II.
- Patients requiring Elective upper limb surgery.

EXCLUSION CRITERIA:

- Patient refusal
- Local site infection, swelling, trauma, deformity
- Bleeding disorders
- Alcoholism or drug abuse
- Chronic analgesic therapy

Method:

In this study patients will be blinded and a resident doctor observing the patient & collecting data will also be blinded. All the patients go through detailed pre-anaesthetic evallustion and necessary investigations, written inform consent was taken. All the patients follow standered starvation protocol

Preparation:

Inside the operation theatre ,baseline monitoring as Hearterate,systolic blood pressure, diastolic blood pressure,SpO2 recorded. Intravenous line secured and iv fluids started. Pre medication was done with Injection Ondansetron 4mg, Injection Glycopyrolate 4ug/kg and Injection Fentanyl 1ug/kg.

Equipment's required to perform block:

- A portable sterile tray containing: Antiseptic solution bowl, Syringes containing local anaesthetic drugs and Dexamethasone.
- 5-cm, 22-gauge short-bevel insulated stimulating needle (for supraclavicular block) 10-cm, 22-gauge short-bevel insulated stimulating needle (for infraclavicular block).
- US machine with high frequency linear probe (8-12 MHz).
- Emergency resuscitation equipments, drugs, lipid emulsion for treatment of LAST.
- Working defibrillator, anaesthesia work station prepared.

Groups & Volume of Local anaesthetic:

Patient satisfying inclusion and exclusion criteria will be enrolled for study are divided in to 2 groups as,

Group 1: Brachial plexus block given by supraclavicular approach under ultrasound guidance using Injection Bupivacaine 0.5% 20ml & Injection Dexamethasone 1ml(4 mg).

Group 2: Brachial plexus block given by Infraclavicular approach under ultrasound guidance using Injection Bupivacaine 0.5% 20ml & Injection Dexamethasone 1ml (4 mg).

Total Volume of drug injected will be 21ml.

Premedication: Injection Ondansetron 4mg, Injection Glycopyrolate 4ug/kg and Injection Fentanyl 1ug/kg given intravenously.

DETAILS OF PROCEDURE:

USG GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK TECHNIQUE:

Position:patient in supine position with his/her head turned to the contralateral side.US (linear) probe put in the supraclavicular fossa, parallel to the middle third of clavicle, in the sagittal plane, to see the brachial plexus as a bunch of grapes like cluster of 56 hypoechoic circles just superiolateral to the subclavian artery between the anterior and middle scalene muscles at the lower cervical region. A 23 gauge,1.5 inches long needle inserted in the in- plane technique & local anaesthetic mixture injected The predetermine volume of drug solution will be administered after negative aspiration around the brachial plexus. Proper dispersion of the local anaesthetic agents within the tissue sheath containing the brachial plexus through two different needle position. End of injection have been considered as time **0 min**.

USG GUIDED INFRACLAVICULAR BRACHIAL PLEXUS BLOCK TECHNIQUE: (PARACORACOID APPROACH)

Position:patient in supine position with his/her head turned to the contralateral side. The US linear probe placement medial to the coracoid process below the clavicle. Then probe moved to obtain the optimum image of the middle third of the axillary artery and the brachial plexus's cords which are hyperechoic and recognize their relation to the axillary artery, typically at a depth of 3-5cm.Using in plane approach, the needle will advance caudally and posteriorly with the bevel facing dorsally to a location posterior to the axillary artery. Firstly, injection of 50% of local anaesthetic will done just posterior to the axillary artery after negative aspiration. The other 50% will injected in a U-shaped pattern posterior and to either side of artery after negative aspiration.

The procedure performed and the drugs will be injected by consultant anaesthetist and the student (observer) observed the patients and collect the data for statistical analysis.

Observations

Block performance time:

It Includes Scanning time and Needling time.

Defines as the time from the initial contact of ultrasound probe with the skin after aseptic and antiseptic measures till obtaining satisfactory imaging & Initial needle insertion till complete injection of drugs respectively.

BLOCK CHARACTERISTICS:

Sensory Block: pin prick test for median, ulnar and radial nerve done respectively.

Assessment of sensory block by 3-point scale: score of 0 point for normal sensation,pont of 1 for loss of sensation of pinprick(Analgesia),point of 2 for loss of touch (Anaesthesia).

Onset of sensory block: the time from the end of injection to complete anaesthesia.

Motor Block: will assessed by asking the patient to flex the forearm and hand against gravity and adduct the shoulder.

Motor block will be assessed by Modified Bromage scale for upper limb

Score Criteria

1- Normal motor function with full flexion and extension of elbow, wrist & fingers

2- Decrease motor strength with ability to move fingers only

2- Complete motor block with inability to move fingers.

Onset of motor blockade will be considered as the time from end of injection to the time of inability to do movements.

Surgery allowed when sensory & motor block achieved of point 2.

INTRAOPERATIVE HEMODYNAMIC MONITORING:

It was done periodically at 0 min, thereafter every 5 minutes for the initial 15 minutes, then 30 min & 30 mins interval till the end of surgery.

INTRAOPERATIVE COMPLICATIONS:

Patients observed for hypotension (fall in BP >20% from the baseline), bradycardia (pulse rate < 60/min), respiratory depression (RR<10/min or SpO2 <95%), nausea and vomiting. Standard anaesthesia treatment protocol was given to treat complications.

time of end of surgery was noted and total duration of each case was noted. And patient is shifted to post operative care unit after completion of surgery.

Duration of sensory block: the time between injection of drug to return of pin prick sensation.

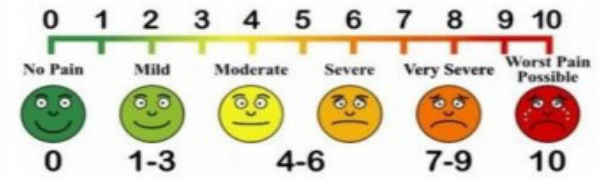
Duration of motor block: the time between injection of drug to return of motor power evaluated by finger and shoulder movement.

POSTOPERATIVE HEMODYNAMIC MONITORING:

Postoperatively pulse rate, blood pressure (SBP, DBP), ECG, oxygen saturation (SpO2), respiratory rate and VAS score were recorded at 0, 30 min then 1, 2, 4, 6, 8, 10,14,16,20,24hrs.

DURATION OF POSTOPERATIVE ANALGESIA :

Whenever VAS ≥ 4 or patient complaint of pain, rescue analgesic(diclofenac sodium 75 mg) was given.Time interval from the end of local anaesthetic injection to the need for first rescue analgesic (VAS ≥ 4) was noted.



Visual Analog Scale for pain assessment

POSTOPERATIVE COMPLICATIONS:

All patients were observed for postoperative complications like pneumothorax, Horner's syndrome, nerve injury and local hematoma. In each patient a chest x-ray was done 6 hours post operatively to rule out pneumothorax.

Statistical Analysis:

Descriptive data of both the groups were compared using unpaired 't' tests. '

P' <0.05= significant(S) and P<0.001 =Highly significant(HS),P>0.05=no significant (NS)

DETAILS OF PROCEDURE

Scanning Time: initial contact of ultrasound probe with the skin after aseptic and antiseptic measures till obtaining satisfactory imaging. That is…….

Needling time: initial needle insertion till complete injection of drugs.

Observations & Results:

TABLE 1: COMPARISON OF DEMOGRAPHIC DATA

Demographics	GROUP 1	GROUP 2	p-value	INFERENCE
GENDER MALE/ FEMALE	 23 (76.67 %)/ 7 (23.33 %)	 19 (63.33%) / 11 (36.67%)	 - -	
AGE(years)	37.23 ±12.36	36±14.78	0.72	NS
WEIGHT (kgs)	61.83± 8.25	61.9±9.61	0.97	NS
DURATION OF SURGERY (mins)	120±44.87	119.33±35.20	0.94	NS

Table 1 shows that demographic data are comparable.(P>0.05)

TABLE 2: BLOCK PERFORMANCE TIME

	GROUP 1	GROUP 2	P-VALUE	INFERENCE
SCANING TIME (SECS)	**36.03±1.69**	**42.3±3.30**	**0.0001**	**HS**
NEEDLING TIME (SECS)	**180.97±5.15**	**200.23±5.54**	**0.0001**	**HS**

GRAPH 1: BLOCK PERFORMANCE TIME

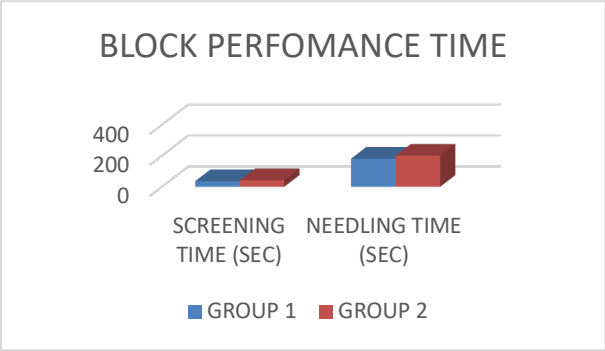
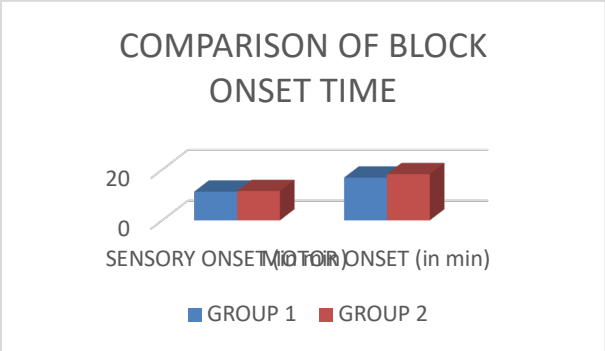


TABLE 3: MEAN SENSORY AND MOTOR ONSET

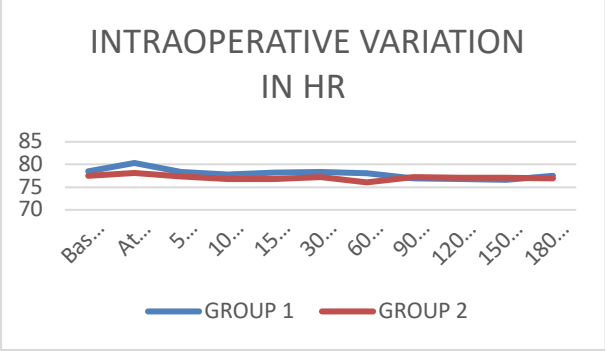
ONSET (in minutes)	GROUP 1 (N=30)	GROUP 2 (N=30)	P-VALUE	INTERFERENCE
SENSORY ONSET (Mean± SD)	11.33± 1.59	11.56± 1.30	0.54	NS
MOTOR ONSET (Mean± SD)	16.86± 3.17	18.23± 3.52	0.11	NS

GRAPH 2: MEAN SENSORY AND MOTOR ONSET

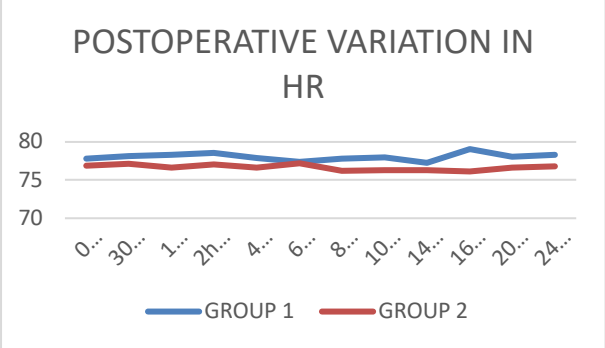


A comparison of the mean sensory and motor onset times is presented in Table 3 and Graph 2.(P>0.05)

GRAPH 3: INTRAOPERATIVE MEAN HEART RATE

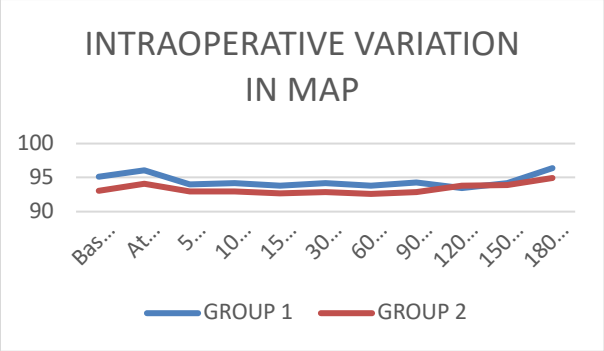


GRAPH 4: POSTOPERATIVE MEAN HEART RATE

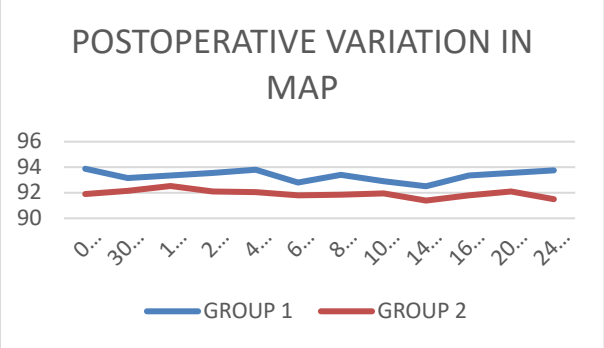


It is clear from table 4 and graphs 3 and 4 that neither group's perioperative heart rate changed statistically significantly.(P>0.05)

GRAPH 5: INTRAOPERATIVE VARIATION IN MAP



GRAPH 6: POSOPERATIVE VARIATION OF MAP



It is clear from graphs 5 and 6 that neither group's mean blood pressure significantly changed over the perioperative period.

TABLE 4: TOTAL DURATION OF SENSORY AND MOTOR BLOCK

DURATION OF BLOCK (hours)	GROUP 1	GROUP 2	P-VALUE	INFERENCE
DURATION OF SENSORY BLOCK (Mean±SD)	16.23± 2.43	17.96± 2.35	0.006	HS
DURATION OF MOTOR BLOCK (Mean±SD)	14.23± 2.60	16.03± 1.47	0.001	HS

GRAPH 7: DURATION OF SENSORY AND MOTOR BLOCK

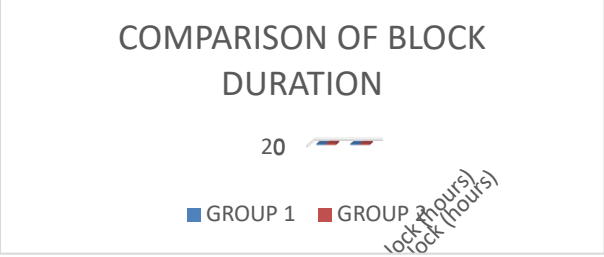
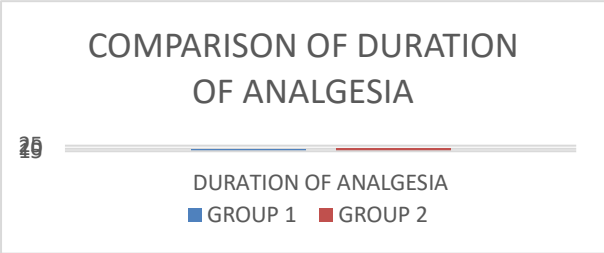


Table 6 and Graph 7 demonstrate that there was no statistically significant difference in the duration of motor and sensory block between the two groups.

TABLE5 : DURATION OF ANALGESIA

	GROUP 1	GROUP 2	P-VALUE	INFERENCE
DURATION OF EFFECTIVE ANALGESIA (hours) (Mean±SD)	18.15± 2.79	20.83± 2.01	0.0001	HS

GRAPH 8: DURATION OF ANALGESIA



From table 5 and graph 7, it is seen that duration of analgesia between two groups shows statistical difference with p value 0.0001(HS). Group 2 has longer duration of analgesia as compared to Group 1. In both groups rescue analgesic request was maximum once (Inj diclofenac sodium 75mg iv).

POSTOPERATIVE COMPLICATIONS

In our study, No patient in any group experienced any complication or unfavourable adverse events.like Pneumothorax, hematoma, Horners syndrome, Nerve injury, Local anaesthetic systemic toxicity

Discussion

Regional anaesthesia is an essential component of modern anaesthetic practice for upper limb surgeries. Brachial plexus block provides several advantages like excellent intraoperative anaesthesia, prolonged postoperative analgesia, reduced opioid consumption, early mobilisation and shorter hospital stay. With the advent of ultrasound guidance, the success rate and safety of peripheral nerve blocks have improved significantly because the anaesthetist can directly visualize neural structures, surrounding vessels and the spread of local anaesthetic in real time.[11,12]

This Prospective randomized double blind clinical study was conducted at our tertiary care hospital. We randomly allotted patients in 2 groups Group 1 (i.e. supraclavicular block group) and Group 2 (i.e. infraclavicular group). Both groups of patients received 20ml of 0.5% Bupivacaine and injection Dexamethasone 1ml(4mg) as adjuvant, total volume of 21ml.

METHOD USED:

Among the various approaches to the brachial plexus block,the supraclavicular and infraclavicular approaches are commonly used for surgeries involving upper limb surgeries.

Borah B et al.[24] use and compare ultrasound versus PNS guided blocks and shows that ultrasound block are better.

The supraclavicular approach blocks the plexus at the level of trunks and divisions where the nerves are closely packed, producing dense anaesthesia of the upper limb. In contrast, the infraclavicular approach blocks the cords of the brachial plexus surrounding the axillary artery and is associated with a lower risk of pneumothorax and improved catheter stability for continuous blocks showed by Franco CD(2006).[13]

DRUG USED:

In our study we took total volume of 20ml 0.5% bupivacaine because S. Ba¸skan, ¸C. Vural, N.A. Erdo_gmu¸s et al.[20] shows in their study to Determination of the minimum effective volume of bupivacaine for ultrasound-guided infraclavicular brachial plexus block was 14 ml. Howeverit was with delay in onset.

As seen in studies by Narayanan et al.[16] and Long zhang et al.[17] where no adjuvant to LA was used as compared to our study, we used Dexamethasone. As dexamethasone as adjuvant to bupivacaine resulted in significantly longer lasting sensory and motor block, post-operative analgesia, and a delayed time for first rescue analgesia without increasing undue side effects.[24] systemically administered dexamethasone has analgesic properties, but only at dose of 0.1mg/kg or above. Perineurally dexamethasone has analgesic effects by increasing peripheral nerve block duration at low doses as low as 1mg, but the lowest dose with consistent effects is 4 to 5mg. that's why here we take 1ml(4mg) dexamethasone.[25]

Demographic Characteristics:

There was no statistically significant difference in Demographic parameters same as Narayanan et al.[16],

Block Performance Time:

Block performance time reflects the technical ease and efficiency of performing a regional block. In our study, we defined block performance time as a total of Scanning time and needling time.

We observed that Mean scanning time in Group 1 and Group 2 was 36.03±1.69 seconds and 42.3±3.30 seconds, respectively. And Mean needling time in Group 1 and Group 2 was 180.97±5.15 seconds and 200.23±5.54 seconds, (p=0.0001).

Narayanan et al.[16] in their study on comparison of USG guided supraclavicular versus infraclavicular brachial plexus block observed that block performance time is longer in infraclavicular block (14.75±2.86 min) than supraclavicular block (9.95±3.17 min)

Long zhang et al.[17] in their study on comparison of USG guided infraclavicular and supraclavicular brachial plexus block observed that block performance time was prolonged in infraclavicular block (6.2±0.7 min) than supraclavicular block (5.1±0.5 min)

Dr.Abhinaya et.al.[14] in their study on comparative study of supraclavicular and infraclavicular brachial plexus block, observed that block performance time was relatively quicker in infraclavicular block (9.57 ± 3.19 min) than supraclavicular block patient (11.53 ± 2.90 min)(.p<0.05)

Ramesh SM. et. al.[15] in their study on comparison of USG guided infraclavicular brachial plexus block and supraclavicular brachial observed that infraclavicular block had shorter duration of block performance time

9.68 ± 1.11 mins vs supraclavicular block which was 10.56 ±1.12 mins which was statistically insignificant.

From the above, it can be seen that block performance time between supraclavicular and infraclavicular block was comparable in most of the studies. The studies of Narayanan et al.[16] And Long zhang et al.[17] showed a similar result to our study which was longer block performance time in infraclavicular block.

Onset of Sensory and Motor Block:

In our study, the mean onset of sensory block was 11.33 minutes in Group 1 and 11.56 minutes in Group 2, (P>0.05). And the mean onset of motor block was 16.86 minutes in Group 1 and 18.23 minutes in Group 2, (P>0.05)

Adinarayanan et al.[22] in their study on comparison of dexamethasone and dexmedetomidine as adjuvant to bupivacaine in supraclavicular brachial plexus block, with 25ml 0.5% bupivacaine and 2ml dexamethasone mean duration of sensory and motor onset is 9.11±3.34 and 15.71±3.78 minutes respectively. Borah B et al.[24] in their study of comparison of Ultrasound versus paresthesia technique for supraclavicular brachial plexus block using 0.5% bupivacaine with 8mg dexamethasone observed that mean onset of sensory and motor block is 5.16 minutes and 10 minutes respectively.

Iyengar et al.[21] in their study of comparison of dexmedetomidine to dexamethasone with bupivacaine in USG infraclavicular brachial plexus block using 25ml 0.5% bupivacaine and 1.5ml dexamethasone observed that onset of sensory and motor block is 13.23±3.46 and 18.53±5.59 minutes respectively.

As compared to our study, the result of motor and sensory blockade in above studies is comparable.

Duration of Sensory & motor Blockage:

In present study, in Group 1 mean duration of sensory block was 16.23±2.43 hours and mean duration of motor block was 14.23±2.60 hours, while in Group 2 mean duration of sensory block was 17.96±2.35 hours and mean duration of motor block was 16.03±1.47 hours. Thus, duration of motor and sensory block was statistically significant.

Adinarayanan et al.[22] in their study on comparison of dexamethasone and dexmedetomidine as adjuvant to bupivacaine in supraclavicular brachial plexus block, with 25ml 0.5% bupivacaine and 2ml dexamethasone observed that duration of sensory and motor block 1619.29±235.49 and 1303.93±233.71 minutes respectively.

Borah B et al.[24] in their study of comparison of Ultrasound /paresthesia technique for supraclavicular brachial plexus block using 0.5% bupivacaine with 8mg dexamethasone observed that duration of sensory and motor block 1343.88 and 1272.88 minutes respectively.

Iyengar et al.[21] in their study of comparison of dexmedetomidine to dexamethasone as adjuvant to bupivacaine in USG infraclavicular brachial plexus block using 25ml 0.5% bupivacaine and 1.5ml dexamethasone observed that duration of sensory and motor block is 1091.79±151.29 and 979.29±141.47 minutes respectively.

Thus, we observed that duration of sensory and motor block is longer as we used adjuvant dexamethasone and it is comparable with above studies.

Hemodynamic Parameters:

In the present study, heart rate and mean arterial pressure remained stable throughout the perioperative periods in both groups, and no statistically significant differences were observed. Regional anaesthesia is associated with greater hemodynamic stability compared to general anaesthesia because it avoids airway manipulation and systemic anaesthetic drugs that may affect cardiovascular function. Neal et al.[26] in their studies evaluating brachial plexus blocks have also reported minimal hemodynamic fluctuations during surgery when regional techniques are used.

Duration of Postoperative Analgesia:

In our study, duration of analgesia in group 1 was 18.25±2.79 hours, while in group 2 it was 20.83±2.01hours with p value 0.0001. It was statistically highly significant and thus infraclavicular brachia plexus block had longer duration of analgesia than supraclavicular block.

Borah B et al.[24] in their study, supraclavicular brachial plexus block using 0.5% bupivacaine with 8mg dexamethasone observed that mean duration of effective analgesia is 1296.25±96.38 minutes.

Adinarayanan et al.[22] in their study on comparison of dexamethasone and dexmedetomidine as adjuvant to bupivacaine in supraclavicular brachial plexus block, with 25ml 0.5% bupivacaine and 2ml dexamethasone observed that the post-operative pain scores and morphine consumption is lower with dexamethasone.

Iyengar et al.[21] in their study, compared dexmedetomidine & dexamethasone as adjuvant to bupivacaine in USG infraclavicular brachial plexus block using 25ml 0.5% bupivacaine and 1.5ml dexamethasone observed that time to first rescue analgesia is 990±170.23 minutes.

Thus, we observed that duration of analgesia was statistically between both groups in above studies, which was similar to our study.

Prolonged postoperative analgesia is one of the major advantages of brachial plexus blocks as it improves patient comfort and reduces the need for systemic analgesics, particularly opioids.

Complications:

There were no complications like Pneumothorax, hematoma, Horner's syndrome, nerve injury and LAST, in perioperative period upto 24 hours observed in patients of any group.

This might be due to ultrasound guided block given by consultant in our study.

Dr. Kaur B et.al.[18] in their study on comparison of supraclavicular and infraclavicular brachial plexus block for upper limb surgeries observed that out of 60 patients under study, 4 patients had accidental vascular puncture in supraclavicular group while none in infraclavicular group. Accidental vascular puncture didn't result in any systemic vascular toxicity.

Kumar N et. al.[23] in his study on comparison of 2 techniques of brachial plexus block – observed 2 cases of

vessel puncture in supraclavicular group while none in infraclavicular group.

Historically, the supraclavicular approach carried a higher risk of pneumothorax when performed using landmark techniques. However, ultrasound guidance has significantly reduced this risk by allowing direct visualization of the pleura and surrounding structures. [12] The absence of complications in the present study highlights the safety of US guided brachial plexus block techniques performed by experienced operators.

Conclusion :

To conclude we observed that both ultrasound guided Supraclavicular and Infraclavicular (Paracoracoid)brachial plexus blocks provided successful Anaesthesia & Analgesia for elective upper limb surgeries.

In nutshell, US guided Infraclavicular (Paracoracoid) block is better alternative to US guided Supraclavicular block,as it provided prolonged sensorimotor blockage and better effective Analgesia.

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