



## COMPARATIVE STUDY OF AXILLARY BRACHIAL PLEXUS BLOCK & BIER BLOCK FOR UPPER LIMB SURGERIES

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### ABSTRACT

**Aim:** To compare axillary brachial plexus block and Bier block in upper limb surgeries in terms of their onset of sensory and motor block, duration of post-operative analgesia and patient satisfaction. **Subjects and Methods:** After approval of the departmental review board and consent from the patients, one hundred six patients with distal upper limb surgeries in the age group of fifteen to sixty years of age of either sex with ASA physical status of 1 & 2 were included in the prospective study. The patients were divided into two groups, *Group A* (Axillary group, N=56, received 40ml of 1% lidocaine with adrenaline 1:200000) and *Group B* (Bier's group, N=50, received 40ml of 1% lidocaine). Onset of sensory and motor block, duration of sensory block, duration of analgesia, patient satisfaction were noted. **Results:** The mean age of patients was 28.3 years for axillary blocks and 34 years for Bier block. Both the groups were comparable in terms of gender. The mean duration of surgery was longer in Group A as compared to Group B ( $p < 0.001$ ). The mean onset of sensory and motor block was quick in Group B ( $p < 0.001$ ), Mean duration of sensory block and Mean duration of analgesia in Group A was higher than in Group B ( $p < 0.001$ ). Patient satisfaction as measured on the basis of Visual analogue scale (VAS) was higher in Group A as compared to Group B ( $p < 0.001$ ). **Conclusion:** Axillary brachial plexus block provides adequate anaesthesia and post-operative analgesia of prolonged duration. It is well tolerated by the patients.

**KEYWORDS:** Bier block, axillary plexus block, upper limb.

### INTRODUCTION

The use of regional anesthesia techniques offers substantial advantages over general anesthesia for outpatient surgery. The high degree of alertness allows patients to be ready for discharge very quickly. The analgesia provided by local anesthesia not only improves patient satisfaction but also avoids side effects of opioids or general anesthesia, thus reducing the incidence of nausea and vomiting and avoiding the most common sources of delay of discharge. Several procedures are carried out in the Accident and Emergency Department such as fracture manipulations, tendon repairs, fasciotomies require upper limb anesthesia. Traditionally, this has been achieved using general anesthesia, intravenous regional anesthesia (Bier's block) or intravenous sedation, all of which have their associated problems. Axillary brachial plexus block is a well-recognized method of achieving upper limb anesthesia. However its use in A & E is not common. This form of anesthesia provides sensory and motor block of the limb in addition to sympathetic block to blood vessels, leading to a reduction in post-operative pain and edema. We compared the use of this anesthetic

technique with the use of Bier Block in our A & E department.

### MATERIALS AND METHODS

The Prospective study titled Comparative study of Axillary brachial Plexus block & Bier's block (intravenous regional anaesthesia) for upper limb surgeries was conducted in the Accident and Emergency Department of a tertiary care hospital. One hundred six patients in the age group of fifteen to sixty years of age of either sex with ASA of 1 & 2 were divided into two groups Group A (Axillary block) and Group B (Bier block). Patients allergic to lidocaine or having neurological, cardiovascular disease or bleeding diathesis were excluded from the study. Patients who refused to consent the block were also excluded from the study. Group A (n=56) received 40ml of 1% lidocaine with adrenaline 1:200000 and Group B (n=50) received 40ml of 1% lidocaine. The patients were explained about the procedure before hand & informed consent was taken from them pre-operatively. The visual analogue scale (VAS) scoring system was explained to all patients. Prior to administration of either technique, an intravenous

crystalloid infusion containing was started in the contralateral normal limb. Before the administration of block by either technique, emergency drugs & instruments were kept available to meet any untoward complication. Intra operatively patients were monitored using ECG, NIBP & SpO<sub>2</sub>.

*The axillary brachial plexus block* was performed by using 23-gauge, 1.5-inch, short, beveled needle with extension tubing & two 20- ml syringes. The patient was kept in the supine position with the arm abducted, externally rotated & elbow flexed, so that the hand lies alongside the patient's head. The needle was advanced using the perivascular approach. The anaesthetic solution was injected half (20ml) below & half (20ml) above the artery. However if paraesthesia was felt by the patient it was converted into paraesthesia technique & if blood was aspirated during the procedure, the needle was advanced until aspiration confirmed it had passed just posteriorly (i.e., through the artery) at which time one half of the local anaesthetic solution (20ml) was injected. The needle was then withdrawn until aspiration confirmed that it is just anterior to the artery at which time other half (20ml) of the solution was injected. The musculocutaneous nerve was blocked separately by infiltration of 5 ml of anaesthetic into the belly of coracobrachialis muscle. Median cutaneous & inter-coatobrachial nerves were also blocked by subcutaneous infiltration of 5 ml of anaesthetic solution in a half - ring around the medial aspect of the arm.

**Bier block Technique:** - A 22 G intravenous catheter was placed on the dorsum of the hand in the distal extremity scheduled for the surgery. Another cannula was placed in the other limb in order to deal with any complication which may require intravenous drug administration. Before beginning to perform the block the patients blood pressure was measured. A plastic extension tubing from the catheter was attached to a 50-ml syringe. A pneumatic double tourniquet was placed proximal to the operative site. The extremity was exsanguinated by the application of an Esmarch bandage. The bandage was applied distal to proximal. The tourniquet was inflated after exsanguination & before removal of the bandage. The proximal pneumatic tourniquet was inflated 100 mmHg above the systolic blood pressure. Pulse was checked after inflation to confirm occlusion of circulation. The local anaesthetic solution was then injected over 1-2 minutes period and patient was informed that the limb may start to feel hot & skin will take on mottled appearance. The pressures in the tourniquet was constantly monitored & maintained at least 100 mmHg above the patients systolic blood pressure. The area anesthetized included the distal extremity upto the area of proximal tourniquet. If the tourniquet discomfort began, the distal tourniquet was inflated, as this area was already anesthetized & the proximal tourniquet was deflated. Tourniquet pain is

usually the limiting factor for success of this technique. After injection of local anaesthetic solution, *sensory block* was assessed by pin prick method using 22 gauge short beveled needle at 1 minute intervals. Motor function was assessed by asking the subject to flex or extend his/ her fingers. When the patient couldn't make any voluntary movement of fingers, a complete motor block was said to be achieved. Onset of sensory block was noted as the time elapsed from the injection of the drug to the loss of pin prick sensation. Onset of motor block was noted as the time elapsed from the injection of the drug to the loss of finger movements. Duration of sensory block was noted as the time elapsed from the injection of the drug to the recovery from sensory disturbances. Patient's who scored more than 4 in terms of VAS score in the post-operative period were given the rescue analgesic Tramadol 50 mg intravenously slowly Patient satisfaction was measured on the basis of Visual analogue scale (VAS) for pain assessment.

#### Statistical Analysis

Statistical Analysis was performed with Graphpad/Instat software and parameters were expressed as Mean  $\pm$  SD and the results thus obtained were statistically evaluated using students t-test for inter-group comparison and non-parametric intergroup comparison was done by Chi square and Mann-Whitney U-test. P-value <0.05 was considered significant.

#### RESULTS

The mean age of patients was 28.3 years in Group A and 34 years in Group B ( $p=0.058$ ). Both the groups were comparable in terms of gender. The mean duration of surgery was longer in Group A as compared to Group B ( $p<0.001$ ). The mean onset of sensory and motor block in Group A was higher than in Group B ( $p<0.001$ ). Mean duration of sensory block in Group A was higher as compared to the Group B ( $p<0.001$ ). Mean duration of analgesia was more in Group A than Group B ( $p<0.05$ ) (Table 1). In Group A, patients were more satisfied and required the rescue analgesic after the 2<sup>nd</sup> hour post-operatively, whereas the patients in Group B required rescue analgesic in the first half-hour period ( $p<0.001$ ) (Table 3). No complication occurred during the procedure with any of the techniques. Post-operative period was uneventful.

Table 1:

Parameter		Group A	Group B	P-value
Age(years)		28.32±10.21	34.22±13.99	0.058
Gender	Male	46	38	0.479
	Female	10	12	
Duration of surgery (minutes)		99.29±39.7	40.56±5.69	<0.0001
Onset of sensory block (minutes)		19.29±3.79	5.56±1.67	<0.0001
Onset of motor block (minutes)		18.61±3.3	6.6±1.38	<0.0001
Duration of sensory block (minutes)		157.36±15.2	48.82±6.28	<0.0001
Duration of analgesia (minutes)		181.8±13.99	52.68±5.8	<0.0001

Table 2: Surgical procedures done in the two study groups:

Type of surgical procedure	Group A	Group B	Total
Tendon repair	10	26	36
Tendon and nerve repair	6	0	6
Tendon,nerve and artery repair	10	0	10
Primary suturing of wound	2	0	2
Reimplantation with k-wire fixation	6	4	10
Amputation of Finger	4	2	6
Embolectomy	2	0	2
Fasciotomy for release of dupuytren's contracture	0	2	2
Colle's fracture	8	8	16
Excision of ulcer	0	2	2
Release of flexor retinaculum	2	0	2
Apponenoplasty	2	0	2
Cross-finger flap surgery	0	6	6
Nibbling of bone with closure of wound	2	0	2
Release of flexor tendon contracture/fibrosis	2	0	2
Total	56	50	106

Table 3: Time of rescue analgesic according to VAS Score:

Time	Group A	Group B	P-value
Half hour	0	50 (100%)	<0.0001 (extremely significant)
2 <sup>nd</sup> Hr	22 (39.29%)	0	
3 <sup>rd</sup> Hr	22 (39.29%)	0	
4 <sup>th</sup> Hr	12 (21.429%)	0	
Total	56	50	

## DISCUSSION

An axillary block is the most commonly performed variety of brachial plexus block in upper extremity surgery. The landmarks are easy to identify and the complications are fewer than with other approaches to the brachial plexus. The technique may be used to provide anaesthesia for a variety of surgical procedures on the hand and forearm. Although in some patients the block may extend above the elbow it does not do this reliably.<sup>[1]</sup> Many techniques have been described including trans-arterial approach, loss of resistance technique, paresthesia elicitation technique, use of peripheral nerve stimulators and more recently the use of ultrasound guidance.

Intravenous regional anaesthesia (IVRA) is a simple and effective method of producing analgesia of an extremity by intravenous injection of local anaesthetic, while the circulation is interrupted by application of a tourniquet. The technique of intravenous regional anaesthesia,

originally given by August Bier fell into disrepute because of the side effects associated with agents used for this technique. The use of prilocaine even though claimed to produce longer duration of post cuff release analgesia did not gain popularity because of methemoglobinemia. With the introduction of lidocaine hydrochloride, the technique was described to be safe and reliable.<sup>[2]</sup> The present study was aimed to compare the onset of sensory and motor blockade, duration of sensory block and analgesia and patient satisfaction with either of the above mentioned techniques. The drug used in the study was lidocaine.

In our study, we used 0.2% lidocaine(40 ml) with epinephrine 1:200000 in Group A patients and 0.5% lidocaine (40 ml) in Group B patients. We found that extent of analgesia was excellent and patient satisfaction was better with Group A patients.

The onset of sensory block in our study in Group A is  $19.3 \pm 3.8$  minutes which corresponds to that of Tamilselvan *et al.*<sup>[3]</sup>, Hingorani AP *et al.*<sup>[4]</sup>, Adnan T *et al.*<sup>[5]</sup> The onset of sensory block in our study in Group B is  $5.6 \pm 1.7$  minutes which is in congruence with that of Brown EM *et al.*<sup>[6]</sup>, who observed the onset of sensory block to occur within 3-5 minutes. The same has been observed by Zekiye Bigat *et al.*<sup>[7]</sup>, H Micheal Bell *et al.*<sup>[8]</sup>, Sorbie C *et al.*<sup>[9]</sup> The onset of sensory block difference between Group A and Group B is statistically significant with p-value,  $<0.0001$ , the onset being rapid in Group B. This is in confirmation with that of Mackay CA and Bowden DF<sup>[10]</sup> and Vincent WS Chan *et al.*<sup>[11]</sup>

The onset of Motor Block in Group A is  $18.6 \pm 3.3$  minutes which is in congruence with that Hingorani AP *et al.*<sup>[4]</sup>, Simon MA *et al.*<sup>[12]</sup>, Shalini Dhir *et al.*<sup>[13]</sup>, while the onset of Motor Block in Group B is  $6.6 \pm 1.4$  minutes which is in confirmation with the findings of Alparslan Turan *et al.*<sup>[14]</sup>, H Micheal Bell *et al.*<sup>[8]</sup>, Sorbie C *et al.*<sup>[9]</sup> The difference between the two groups in terms of their motor block onset time is statistically significant with p-value  $<0.0001$  as shown by the findings of Mackay and Bowden.<sup>[10]</sup>

The Duration of sensory block in Group A is  $157.4 \pm 15.2$  minutes and that in Group B is  $48.8 \pm 6.3$  minutes (p-value  $<0.0001$ ). The duration of sensory block in Group A is in confirmation with that of Movafegh A *et al.*<sup>[15]</sup>, Nishikawa K *et al.*<sup>[16]</sup>, Mackay and Bowden<sup>[10]</sup>, Bouziz H<sup>[17]</sup> while the duration of sensory block in Group B is in confirmation with that of S Sen *et al.*<sup>[18]</sup> The statistical significance between the two groups in terms of their sensory block duration is in confirmation with that Mackay and Bowden<sup>[10]</sup>, Vincent WS Chan *et al.*<sup>[11]</sup>

With regard to duration of analgesia, it is  $181.8 \pm 13.9$  minutes in Group A and  $52.7 \pm 5.8$  in Group B (p-value  $<0.0001$ ). The duration of analgesia in Group A is in confirmation with that of Tamilselvan *et al.*<sup>[3]</sup>, Mackay and Bowden<sup>[10]</sup>, Vincent WS Chan *et al.*<sup>[11]</sup> The mean duration of analgesia in Group B IS  $52.7 \pm 6.3$  minutes and this is in accordance with that of Mackay and Bowden<sup>[10]</sup>, Vincent WS Chan *et al.*<sup>[11]</sup>

The analgesia and patient satisfaction with either technique was measured in terms of visual analogue scale (VAS). The patients were more satisfied in Group A. The VAS score was lowest for Group A patients as compared to VAS score in Group B patients. This is also shown by the studies of Mackay and Bowden<sup>[10]</sup>, Vincent WS Chan *et al.*<sup>[11]</sup> The reason for this difference is the mild tourniquet discomfort.

No complications occurred during the procedure with any of the techniques. Post-operative period was uneventful.

## CONCLUSION

The regional anesthetic techniques are suitable for hospitals with great influx of patients and limited bed

capacity, suitable for operations on distal part of upper limbs. Though the intravenous regional anesthesia has rapid onset and recovery of both sensory and motor block, the problem lies in the lack of post-operative analgesia and short duration of the block, usually less than one hour. The axillary plexus block offers alternative approach to these patients requiring upper limb anesthesia in A and E department. It is easy and simple to perform, provides adequate anesthesia and post-operative analgesia for prolonged period. The procedure is well tolerated by the patients.

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