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Original Article

Dexamethasone Improves Outcome Of Infraclavicular Brachial Plexus Block

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ABSTRACT

Objectives : *The present study aimed to evaluate the competence of infraclavicular brachial plexus block (ICB) for patients assigned for hand and forearm surgery and the effects of using a combination of dexamethasone and local anesthetic for block*

Patients & Methods : *This study included 40 ASA I and II patients randomly allocated into 2 groups: Control group received 38 ml of lidocaine 1.5% and 2 ml normal saline and Study group received 38 ml of lidocaine 1.5% mixed with 2 ml (8 mg) dexamethasone. All blocks were performed using a nerve stimulator and an insulated needle depending on provocation of a distal motor response in the hand or the wrist. The sensory block was assessed and degree of sensory block was evaluated on 3-point scale with 0=no sensation to 2=normal sensation. A successful block was defined as sensory block score=0 in the four major nerve distributions; for incomplete block, selective supplementation at the humeral canal was performed but if more than 2 nerves remained unblocked, the procedure was considered failed and general anesthesia was performed. Block performance time; latency time, duration of analgesia and degree of motor block were evaluated. Procedure related complications and patient satisfaction with anesthetic technique were assessed.*

Results : *The block was successful in 27 patients but totally failed with shift to general anesthesia in 5 patients and in 8 patients the response was incomplete block with a total success rate of 87.5%. The mean block performance time of ICB showed non-significant difference between both studied groups. However, dexamethasone combination significantly reduced latency time and provided significantly longer duration of sensory and motor block in comparison to control group. However, mean motor block scores and VAS of discomfort during ICB showed a non-significant difference between both groups. Six patients; 4 in control and 2 in study groups, refused to repeat the procedure once again with a satisfaction rate of 85%. Adverse effects were encountered in 2 patients (5%) with a non-significant difference between both groups.*

Conclusion : *It could be concluded that infraclavicular brachial plexus block is an appropriate anesthetic modality for hand and forearm surgery with procedural success rate of 87.5% and combination of local anesthetic with dexamethasone improved its outcome in the form of significantly shorter latency time and prolonged postoperative analgesia with higher patients' satisfaction rate.*

INTRODUCTION

Brachial plexus blocks provide a useful alternative to general anesthesia for upper limb surgery. They achieve ideal operating conditions by producing complete muscular relaxation, maintaining stable intraoperative hemodynamics, and the associated sympathetic block decreases postoperative pain, vasospasm and edema, [1].

There are multiple approaches for brachial plexus block; for shoulder and proximal humeral surgery, interscalene and cervical paravertebral approaches to the brachial plexus appear to provide equally effective surgical anesthesia. For surgery at or below the elbow, an infraclavicular block may result in decreased performance time and block-related pain while providing similar efficacy compared to multiple-stimulation axillary and brachial canal approaches, [2].

However, the numerous benefits of regional anesthesia for upper extremity surgery such as improved analgesia, opioid sparing and

reduced side effects are lost after block regression. Several strategies such as continuous ambulatory local anesthetic infusions have been described and investigated, [3]. An alternative to this strategy is to combine adjuvants such as opioids, clonidine, ketamine and neostigmine to potentiate the effects of local anesthetics. These additives have had mixed results. The most promising solutions are the alpha-2-adrenergic agonists but further investigation is necessary to confirm their efficacy and quantify their appropriate dose and side effects, [4].

The present study aimed to evaluate the competence of infraclavicular brachial plexus block as anesthetic strategy for patients assigned for hand and forearm surgery and the effects of using a combination of dexamethasone and local anesthetic for block.

PATIENTS & METHODS

This prospective comparative study included 40 ASA I and II patients assigned for hand or forearm surgery under infraclavicular brachial plexus block after receiving Institutional Ethical Committee approval and informed written consent. Patients younger than 18 or older than 60 years, patients with cardiac or chest diseases or bleeding diathesis, patients with diabetes mellitus, steroid therapy and pregnant women were excluded from the study. After insertion of an IV catheter in the contralateral arm, standard monitoring was applied (pulse oximetry, electrocardiography and noninvasive blood pressure). Patients were randomly allocated into 2 groups : control group assigned to receive 38 ml of lidocaine 1.5% and 2 ml normal saline, and study group assigned to receive 38 ml of lidocaine 1.5% mixed with 2 ml (8 mg) dexamethasone.

All blocks were performed using a nerve stimulator (Braun, Stimuplex, HNS 11) and an insulated needle (Braun Stimuplex, 50 mm and 22-guage Mesungen, Germany). The nerve stimulator was set at 100 μs, 1.4 mA, and 2 Hz. A distinct distal motor response at the level of the hand or wrist at a current output ranging between 0.3 and 0.5 mA was obtained in all patients. Patients were placed supine, with the head turned away from the arm to be anesthetized as previously described by Minville et al., [5]. The forearm was placed on the abdomen. The puncture site was located 1 cm under the clavicle and 1 cm medially to the coracoid process (Fig. 1). After antiseptic preparation of the area, the insulated needle was inserted toward the top of the axillary fossa (in relation to the axillary artery) with an angle of 45° to the skin to locate the musculocutaneous nerve and 10 ml of the solution was injected with repeated aspiration. The needle was then withdrawn 1 or 2 cm and redirected medially and posteriorly to stimulate the lateral, medial, or posterior cord and 30 ml fractionated doses with frequent aspiration of the same solution were slowly injected. A distal motor response in the hand or the wrist was identified; 3rd finger flexion was accepted as a median nerve stimulated response, 5th finger flexion as an ulnar stimulated response, and finger or wrist extension as radial nerve-stimulated response. The first distal nerve response found was considered to be an adequate end point. Thirty milliliters of the same solution in fractionated doses was then slowly injected with frequent aspiration.

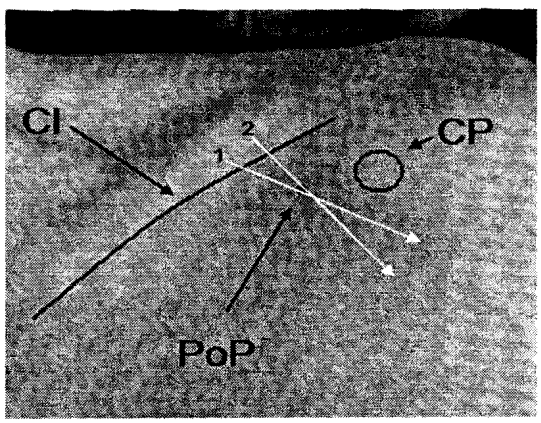

Fig. (1) : Landmarks and site of puncture of the infraclavicular brachial plexus block, [5].
1. First needle direction: the needle is directed toward the axillary fossa.
2. Second needle direction: the needle is directed medially and posteriorly.

Cl : clavicle, CP: coracoid process
PoP : point of puncture.

The sensory block was assessed every 5 minutes and degree of sensory block was evaluated on 3-point scale with 0 = no sensation, 1 = hypoesthesia, and 2 = normal sensation. A successful block was defined as the absence of cold (alcohol soaked swab) and pinprick response (score = 0) in the four major nerve distributions: radial (posterior wrist and first three fingers), medial (anterior wrist and first three fingers), ulnar (medial part of wrist and hand), and musculocutaneous (lateral part of forearm). The medial brachial and antebrachial cutaneous (medial part of the arm and forearm) nerve distributions were tested as well as the shoulder area for incidental axillary nerve block. Extent of sensory block was determined in comparison to sensation on the contralateral arm.

If one or two nerves were not blocked, selective supplementation at the humeral canal was performed using a nerve stimulator. If more than 2 nerves remained unblocked, the procedure was considered failed and general anesthesia was performed. The results of the block have been classified collectively as follows: successful =excellent analgesia, incomplete =non perfect analgesia, that left some places of the plexus uncovered, the patient is complaining of bother and/or pain with necessity of venous analgesia and soothing or failure =necessity of general analgesia.

The following parameters were recorded: block performance time (from insertion to removal of the neurostimulation needle); latency time (from end of block to the time the patient was ready for surgery, that is, analgesia and/or anesthesia in the five sensory areas evaluated) and duration of analgesia (from end of block to the start of pain sensation).

Degree of motor block was evaluated at the same time as sensory block in relation to forearm flexion (musculocutaneous), flexion of the hand (median), abduction and adduction of the fingers (ulnar), and wrist extension (radial). Measurements were performed using a modification of the Lovett rating scale, [6] from 6 (normal muscular force) to 0 (absence of mobility) at 10, 20 and 30 minutes after end of block.

Immediate complications; namely, venous puncture, arterial puncture, vascular absorption of the local anesthetic, overdose, recurrent laryngeal or phrenic nerve block, residual paresthesia, Horner's syndrome, and pneumothorax and late complications namely; pain, paresthesia, hematoma or infection were noted.

Patient satisfaction with anesthetic technique was assessed after arrival in the post-anesthesia care unit using a 5-point scale where 0=dissatisfied and 5=very satisfied and included inquire about discomfort associated with insertion of the needle and use of the nerve stimulator, as well as if they would undergo the same anesthetic procedure in the future.

Statistical analysis :

Obtained data were presented as mean ± SD, ranges, numbers and ratios. Results were analyzed using Z-test and Chi-square test. Statistical analysis was conducted using the SPSS (Version 10, 2002) for Windows statistical package. p-value < 0.05 was considered statistically significant.

RESULTS

The study comprised 40 patients; 29 males (72.5%) and 11 females (27.5%) with mean age of 42±11.1; range 21-56 years. There were 31 patients ASA I and 9 patients ASA II. There was a non-significant ($p>0.05$) difference between patients allocated in both groups as regards demographic data, ASA status, and surgical data, (Table 1 & 2).

The block was successful in 27 patients but totally failed with shift to general anesthesia in 5 patients and in 8 patients the response was incomplete block required selective supplementation at the humeral canal, (Fig. 2). Failure of block of median and ulnar nerves was reported in 6 patients and one had radial and another had musculocutaneous block failure, (Table 3).

The mean block performance time of ICB showed non-significant difference between both studied groups. However, dexamethasone combination significantly reduced latency time in study group, (18.5 ± 2.7; range : 14-23 min) compared to control group (22.4 ± 3.9; range : 16-29 min), received plain lidocaine, (Fig. 3). Moreover, dexamethasone combination provided significantly longer duration of

sensory, (Fig. 4) and motor block in comparison to control group, (Table 4, Fig. 5).

Mean motor block scores evaluated at 10, 20 and 30 minutes showed a progressive decrease in both groups but with non-significant difference between both groups, (Table 5). The mean total VAS of discomfort during ICB was 4.6 ± 1.2; range: 2-7; however, mean VAS score was non-significantly reduced (Z=1.242, p > 0.05) in study group (4.4 ± 1.1; range: 2-6) compared to control group, (4.8 ± 1.3 ; range : 2-7).

Seven patients (17.5%) attributed their discomfort to needle insertion; 4 in control and 3 in study groups, while 14 patients (35%) attributed it to nerve stimulation; 6 in control and 8 in study groups and 19 patients (47.5%); 10 in control and 9 in study groups, attributed their discomfort to both needle insertion and application of nerve stimulator, (Fig. 6). Six patients; 4 in control and 2 in study groups, refused to repeat the procedure once again if they required to do, while the other 34 patients; 16 in control and 18 in study groups, accepted to repeat it once again if they required to do, (Table 6, Fig. 7). There was a non-significant (p > 0.05) difference between both groups as regards both cause of discomfort or acceptance for procedure repetition, (X^2 = 0.601 & 0.86, p > 0.05, respectively).

Adverse effects were encountered in only 2 patients (5%); one had venous puncture and the other has residual parasthesia.

Table (1) : Patients' demographic data and ASA status.

	Control	Study	Total
Age (years)	43±10.3	40.9±12	42±11.1
Sex; M:F	15:5	14:6	29:11
Weight (Kg)	82.8±3.7	83.4±3.5	83.1±3.6
Height (cm)	168.6±2.8	169.6±1.5	169.1±2.2
BMI (Kg/m^2)	29.1±1.5	29±1.3	29.1±1.4
ASA; I:II	16:4	15:5	31:9

Table (2) : Patients' surgical data.

		Control	Study	Total
Surgical site	Hand	6	6	12
	Wrist	10	9	19
	Forearm	3	3	6
	Elbow	2	2	4
Tourniquet duration (min)		64.3±9.4	61.3±11.9	62.8±10.7
Surgical duration (min)		53±10.7	48±13.3	50.5±12.2

Table (3) : Technique related data.

		Control	Study	Total
Successful		14 (70%)	13 (65%)	27 (67.5%)
Incomplete block	Musculocutaneous	0	1 (5%)	1 (2.5%)
	Median	2 (10%)	1 (5%)	3 (7.5%)
	Ulnar	1 (5%)	2 (10%)	3 (7.5%)
	Radial	1 (5%)	0	1 (2.5%)
Failed		2 (10%)	3 (15%)	5 (12.5)

Table (4) : Infraclavicular block performance data.

Variable	Control	Study	Statistical differences	
			Z	p
Block performance time (min)	9.3±1.7 (7-12)	8.6±1.3 (6-11)	1.442	> 0.05
Latency time (min)	22.4±3.9 (16-29)	18.5±2.7 (14-23)	3.105	= 0.002
Duration of sensory block (min)	134.5±25.9 (105-180)	279.4±63 (230-450)	3.920	< 0.001
Duration of motor block (min)	206.9±37 (145-245)	344.7±59.4 (260-480)	3.921	< 0.001

Table (5) : Motor block scores.

Time	Control	Study	Statistical differences	
			Z	p
10-min	3.4±0.62	3.12±1.1	1.165	>0.05
20-min	2.5±0.9	2.06±0.9	1.625	>0.05
30-min	1.94±0.75	1.89±0.68	0.577	>0.05

Table (6) : Assessment of patients' comfort during ICB.

Variable		Control	Study	Total
ICB discomfort judged by VAS		4.8±1.3 (2-7)	4.4±1.1 (2-6)	4.6±1.2 (2-7)
Cause of discomfort	Needle insertion	4 (20%)	3 (15%)	7 (17.5%)
	Nerve stimulation	6 (30%)	8 (40%)	14 (35%)
	Both	10 (50%)	9 (45%)	19 (47.5%)
Acceptance for procedure repetition if needed	Yes	16 (80%)	18 (90%)	34 (85%)
	No	4 (20%)	2 (10%)	6 (15%)

ICB: infraclavicular block VAS: visual analogue scale