

## Original Article



# Effect of Dexamethasone on The Duration of Analgesia for Supraclavicular Brachial Plexus Block

Md. Rafiqul Islam<sup>1</sup>, Laila Yesmin<sup>2</sup>, Md. Pervez Rahman<sup>3</sup>, A.B.M Shafiul Anam Khan<sup>4</sup>,  
Md. Miraj Hossain<sup>5</sup>, Md. Mezanur Rahman<sup>6</sup>, Rahena Khatun<sup>7</sup>, Md. Muzibur Rahman<sup>8</sup>.

### Abstract

**Background:** Brachial plexus block with Bupivacaine provides effective intraoperative anesthesia and analgesia. The use of dexamethasone along with local anesthetic has been shown to improve the duration of analgesia. **Objective:** To observe the effect of Dexamethasone on the duration of analgesia for Supraclavicular Brachial plexus block. **Materials and Methods:** A prospective, double-blind study was undertaken in patients scheduled for upper limb surgeries under supraclavicular brachial plexus block. patients were randomly divided into two groups, Group (BD) and B. Group B received 28 ml of 0.25% bupivacaine with 2 ml normal saline while Group BD received 28 ml of 0.25% bupivacaine with 2ml (8mg) dexamethasone for supraclavicular brachial plexus block. The groups were compared regarding quality of sensory and motor blockade. All the information was recorded in data collection sheet. Data was processed and analysed with the help of computer program SPSS and Microsoft excel. **Results:** There was no significant difference between groups in respect of demographic and American Society of Anaesthesiologist (ASA) status. Mean age was found to 34.7±8.53 years. In Group (BD) , 63.3% were ASA I and 36.6% were ASA II. In Group B, 60% were ASA I and 40% were ASA II. It has become evident that satisfactory anaesthesia can be made possible by addition of adjuvant to local anesthetic in brachial plexus block (in Group-BD). onset of sensory block was faster in Group BD (8.17 ± 1.4 min) than Group B (9.12 ± 1.68 min). Similarly mean onset time of motor block in group A was 12.26 ± 3.96 min, and 11.58 ± 3.68 min in group B. Our study shows that duration of motor block was 408.68±26.96 min and 380.26 ± 24.11 min in group BD and Group B respectively. **Conclusion:** There was significantly prolonged duration of analgesia in addition of Dexamethasone without any unwanted effects.

**Key words:** Brachial Plexus Block, Bupivacaine, Dexamethasone.

**Date of received:** 09.07.2020.

**KYAMC Journal.2021;11(4):199-203.**

**Date of acceptance:** 25.11.2020.

**DOI:** <https://doi.org/10.3329/kyamcj.v11i4.51997>

### Introduction

Brachial plexus block is especially intended for the upper limb surgeries. Brachial plexus block avoids unwanted complications due to administration of various drugs in general anesthesia and in the process of upper airway instrumentation. Local anesthetics in peripheral block exert their effect either by inhibiting the excitatory process in the nerve endings or in the nerve fibers. The sequence of events is generally accepted as the mechanism of action of local anesthetic agents are: binding of the local anesthetic moiety to the receptor sites in the nerve membrane, reduction in sodium permeability, decrease in the rate of depolarization, failure to achieve threshold potential,

lack of development of propagated action potential and conduction blockade. Brachial plexus blockade is the cornerstone of the peripheral nerve regional anesthesia practice of most anesthesiologists now-a-day.<sup>1</sup>

There are essentially four approaches to a brachial plexus block: interscalene, supraclavicular, infraclavicular and axillary. Compared to the axillary approach, a brachial plexus block at the level of the clavicle can anesthetize all four distal upper extremity nerve territories without a requirement for a separate block of the musculocutaneous nerve.<sup>2</sup> The first brachial plexus block was performed in 1885 with cocaine by

1. Associate Professor (C,C), Department of Anaesthesia, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh.
2. Associate Professor, Department of Forensic Medicine, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh.
3. Assistant Professor, Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh.
4. Assistant Professor, Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh.
5. Assistant Professor, Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh.
6. Assistant Professor, Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh.
7. Associate Professor, Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Sirajganj, Bangladesh.
8. Professor and HOD, Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Sirajganj, Bangladesh.

**Correspondence:** Dr. Md. Rafiqul Islam, Associate Professor (C,C), Department of Anaesthesiology, Khwaja Yunus Ali Medical College and Hospital, Enayetpur, Sirajganj, Bangladesh, Mobile:01712621229, email:rafiq.paban@gmail.com

Halstead. In 1911, Hirschell described the first percutaneous technique for performing the block.<sup>3</sup> In recent years it has gained popularity with addition of various adjuncts to local anaesthetic solution in an attempt to increase its efficacy and duration. Systemic adverse effects and prolonged motor block are avoided along with a reduction in total dose of local anaesthetic used. Adjuncts like fentanyl, adrenaline, epinephrine, bicarbonate opioids, clonidine, neostigmine and tramadol have been injected concomitantly with local anaesthetic solution.

Local anaesthetics alone provide analgesia for not more than 4-8 hours. Increasing the duration of local anesthetic action is often desirable because it prolongs surgical anesthesia and analgesia. Different additives have been used to prolong regional blockade. Vasoconstrictors can be used to vasoconstrictor vessels, thereby reducing vascular absorption of the local anesthetic.<sup>4,5</sup> The pattern of block is partly determined by the approach used, and it is important to relate the surgical requirements to the features of the specific method because each has its limitations in regard to the extent of block and the risk of side effects.

Bupivacaine has been extensively studied in brachial plexus block. When the minimum local analgesic concentration is reached close to the membranes of the axons, the molecules block the sodium channels, in the resting position. In this way, the transmission of the nerve impulses stops. Adjuvants are added to decrease the dose of local anesthetic and to improve quality and duration of analgesia. Adjuvants such as dexamethasone, tramadol are added to local anesthetics to improve the quality of nerve blocks.<sup>6,7</sup>

Dexamethasone is an anti-inflammatory drug, seems to pass the neuronal membrane and diffuse within the interstitial or axonal fluid since it is a lipophilic drug. Steroids induce a degree of vasoconstriction which results in reduced local anesthetic absorption.<sup>8</sup> Steroids suppress the synthesis and secretion of various inflammatory mediators which prolongs the period of analgesia. Recently several studies have observed early-onset and prolong duration of analgesia with the use of Dexamethasone, a long-acting glucocorticoid in Supraclavicular Block.<sup>9</sup> It is commonly used to reduce postoperative nausea, vomiting, pain and to improve the quality of recovery after surgery.

The mechanism of Dexamethasone to show such effects may be by attenuating the release of inflammatory mediators, reducing ectopic neuronal discharge and inhibiting potassium channel-mediated discharge of nociceptive C-fibres. However, many studies have shown variable time to onset and duration of analgesia. Therefore aim of this study was to evaluate the efficacy of Dexamethasone as an adjuvant to bupivacaine in supraclavicular approach of brachial plexus block.

## Materials and Methods

This randomized comparative study was conducted in the Department of anaesthesiology, at Khwaja Yunus Ali Medical College and Hospital, KYAMCH, Sirajganj, Bangladesh from January 2019 to June 2020, to observe the effect of Dexamethasone on the duration of analgesia for Supraclavicular Brachial plexus block. Total 60 adult patients

of either sex, aged 18 to 60 years with American Society of Anesthesiologists (ASA) physical status I and II posted for elective orthopedic surgeries of the elbow, forearm, wrist and hand under Supraclavicular brachial plexus block were enrolled in this study. Patients were equally allocated in a randomized manner by a sealed envelope technique into two groups. Patients in Group B received 28 mL 0.25% bupivacaine and 2 mL 0.9% normal saline whereas patients in Group BD received 28 mL 0.25% bupivacaine and 2 mL dexamethasone (8 mg). Exclusion criteria included in this study were patients' refusal, ASA physical status III and more, patients with a history of peptic ulcer disease, uncontrolled diabetes mellitus and hypertension, cardiorespiratory disease, hepatic or renal failure, pregnancy, coagulopathy, significant neurological and psychiatric disease, patient on psychotropic drugs or chronic analgesic therapy, known hypersensitivity to the study drugs, adequate block not obtained within 30 minutes of injection, any perioperative complication related to the block and duration of surgery more than 2 hours. All patients were advised for nil per oral after midnight before the surgery day.

On the day of surgery, the procedure for the block was explained and monitors were attached. Brachial plexus block was done with the help of nerve stimulator. The 22-gauge 5 cm, an insulated needle was used and the position of the needle was considered to be acceptable when an output current < 0.5 mA still elicited a slight distal motor response in forearm and hand. The intensity of pain was assessed by 1-10 Pain Visual Analog Scale (1- no pain and 10- worst imaginable pain). Heart rate, peripheral oxygen saturation, respiratory rate, and blood pressure were measured before the block (baseline), then different follow up time after the block. Comparison of time of onset and duration of the sensory blockade between two groups was our primary outcome measures whereas the comparison of time of onset and duration of motor blockade between the groups was our secondary outcome measures. Onset time of sensory block was defined as the time interval between the end of local anesthetic injection and loss of sensation to pinprick in all of the nerve distributions. Onset time of motor blockade was defined as the time interval between the end of local anesthetic injection and paresis in all of the nerve distributions. The duration of sensory block was defined as the time interval between the onset of sensory block and the first postoperative pain (VAS-4). The duration of motor block was defined as the time interval between the onset of motor block and complete recovery of motor functions. The duration of Surgery was considered from the starting of skin incision up to the end of skin closure. Sensory and motor blockade were assessed every 2 minutes after completion of injection till 30 minutes and then every 30 min after the end of surgery till first 12 hours, thereafter hourly until the block had completely worn off. After 30 minutes, if the block was considered to be adequate, surgery commenced. If inadequate block, supplemental rescue nerve block was performed and those patients were excluded from data analysis.

Injection Ketorolac 30 mg IV was given as rescue analgesia when VAS-4 cm in the postoperative period. The number of injection Ketorolac given to each patient during the first 24 hours of the postoperative period was recorded. Any side

effects, after the injection of drugs till 24 hours postoperatively was recorded. Statistical analysis of the data was done using the Statistical Package for the Social Sciences for Windows (SPSS Inc., Chicago) software version 22. Qualitative data was compared using Chi-square test. Quantitative data compared using independent t-test. P < 0.05 was taken as statistically significant.

**Results**

Total of 60 patients fulfilling inclusion criteria were studied.

**Table I:** Age distribution of Study population (n=60)

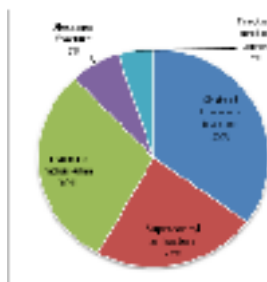
Age (years)	Number of patients		Total & Percentage
	Group (BD) (n=30)	Group B (n=30)	
18-39	21(70.0%)	18(60.0%)	39(65.0%)
40-60	9(30.0%)	12(40.0%)	21(35.0%)
Mean ± S.D.	34.7±8.53		

While studying the distribution of cases by age it was found that majority of the patients i.e. 65.0% were between 18-39 years, 35.0% were between 40-60 years. Mean age was found to 34.7±8.53 years. Comparison was done by Chi-Square (2) test. No significant differences were found between groups with respect to age (Table I).

**Table II:** American Society of Anesthesiologist (ASA) physical status (n=60)

Status	Number of Patient		P value
	Group (BD)	Group B	
ASA I	19(63.3%)	18(60%)	0.790
ASA II	11(36.6%)	12(40%)	

There were no significant difference between the groups (p=0.790). Comparison was done by Chi-Square (2) test. All 60 enrolled patients were randomized to groups, 30 patients of each. All patients were with ASA physical status I and II. Group BD, 19(63.3%) were ASA I and 11(36.6%) were ASA II. Group B, 18(60%) were ASA I and 12(40%) were ASA II (Table II).



**Figure 1:** Distribution of patients according to indications for surgery (n=60)

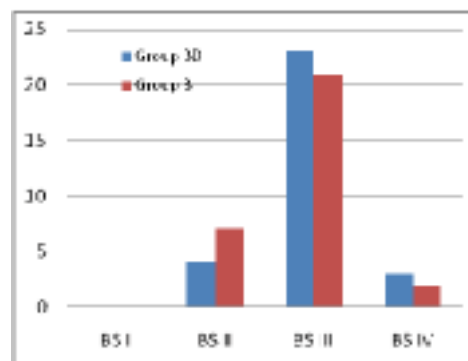
Indication for surgery was shaft of humerus fracture (35.0%), supracondylar fracture (23.0%), fracture radius-ulna (30.0%), olecranon fracture (7.0%), and fracture neck of humerus (5.0%) (Figure 1).

Time to onset of sensory block shows in Table-III. Onset of sensory block was faster in Group BD (8.17 ± 1.4 min) than Group B (9.12 ± 1.68 min). On comparison of the required time to achievement of sensory block between groups, required time was 6-10 minute in 23(76.7%) patients of group-BD versus 19(63.3%) in group-B patients. The result was significant (p value < 0.05).

**Table III:** Time to onset of sensory block (n=60)

Time (min)	Number of patients		p value
	Group BD (n=30)	Group B (n=30)	
5	2(6.7%)	0	
6-10	23(76.7%)	19(63.3%)	
>10	5(16.7%)	11(36.7%)	
Mean ± S.D.	8.17 ± 1.4 min	9.12 ± 1.68 min	0.02 <sup>s</sup>

Figure 2 shows the Bromage scale between groups at 10th minute time. Onset of motor block was 12.26 ± 3.96 min in Group BD patients and 11.58 ± 3.68 min in Group B patients. The difference was statistically non-significant. Time taken to achieve Bromage 3 following anaesthesia was considered as onset of motor block. An average Bromage score of 4 was achieved for the motor block in both groups (p = 0.968)



**Figure 2:** Assessment of Bromage scale and time to onset of motor block (n=60)

Table IV shows time to onset of motor block. The mean onset time of motor block in group BD was 12.26 ± 3.96 min, and 11.58 ± 3.68 min in group B. By evaluating these times, we understood that the required time for initiating motor block in group BD was significantly longer than groups B, but the difference between group was statistically non-significant (p value = 0.968).

**Table IV:** Time to onset of motor block (n=60)

Time (min)	Number of patients		p value
	Group BD (n=30)	Group B (n=30)	
10	4(13.3%)	7(23.3%)	
11 -15	23(76.7%)	21(70.0%)	
>15	3(10.0%)	2(6.7%)	
Mean ± S.D.	12.26 ± 3.96 min	11.58 ± 3.68 min	0.968 ns

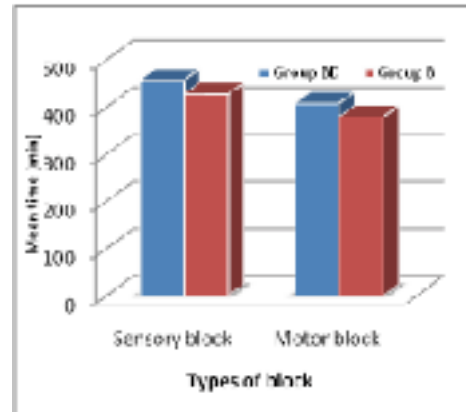
There was no significant difference between the groups as regards Preanaesthesia Mean Arterial Pressure (MAP) (p=0.883), but after anesthesia significant decrease in MAP was seen in all groups compared with basal MAP, the least decrease occurring in the group BD and the highest fall in the group B. At the 15th minute MAP was 76.92 and 69.18 mm of Hg in group BD and group B respectively showing significant difference (p=0.0001). After 45 minute, mean blood pressure was 71.05±6.8 mmHg in group BD and 68.46±9.4 mmHg in group B. Which statistically significant (p<0.05) between two groups but follow up after 60 minute mean BP stabilized to similar in both group, which was statistically not significant (p>0.05) between two groups (Table V).

**Table V:** Trends of mean arterial pressure (MAP) between groups with respect to time (n=60)

Time point after block	MAP (mmHg)		P-value
	Group (n=30)	Group B (n=30)	
Preanaesthesia	69.60±11.6	68.93±9.1	0.883
5 min AS	70.45±8.2	67.90±9.5	0.086
10 min AS	75.40±7.9	70.25±10.2	0.0001
15 min AS	76.92±8.1	69.18±9.5	0.0001
20 min AS	76.31±8.6	68.73±9.1	0.0001
30 min AS	71.57±10.2	69.18±7.5	0.067
45 min AS	71.05±9.3	68.46±11.4	0.435
60 min AS	59.55±6.8	60.52±7.1	1.082

The duration of sensory blockade, defined as the time between onset of sensory block and return of dull pain but VAS<4. The duration of motor block was assessed every 10 minutes till the ability of the patient to first move the fingers. Sensory and motor block lasted longer in the group-BD patients as compared to the group-B, but the difference was statistically non-significant (p>0.05). Present study shows that duration of motor block was 408.68±26.96 min and 380.26 ± 24.11 min in group BD and Group B respectively.

Sensory block was 457.13±36.12 min and 428.15±31.42 min in group BD and Group B respectively. So group-BD considered as better than group-B (Figure 3).



**Figure 3:** Mean duration (min) of motor and sensory block (n=60)

**Discussion**

There were 60 ASA status I and II patients underwent upper limb surgery under supraclavicular brachial plexus block. Study subjects were allocated into one of the two groups, of 30 each- group BD & B. There was no significant difference between groups in respect of demographic and ASA status. It was found that majority of the patients i.e. 65.0% were between 18-39 years, 35.0% were between 40-60 years. Mean age was found to 34.7±8.53 years. In this study Group BD, 19(63.3%) were ASA I and 11(36.6%) were ASA II. Group B, 18(60%) were ASA I and 12(40%) were ASA II. Findings consistent with result of other study.<sup>6-9</sup>

It has become evident that satisfactory anaesthesia was made possible by addition of adjuvant to local anaesthetic in brachial plexus block. Brachial plexus block is widely used in upper limb surgeries. Many adjuvants are added to local anaesthetics to improve the quality and duration of blockade. In this study onset of sensory block was faster in Group BD (8.17 ± 1.4 min) than Group B (9.12 ± 1.68 min). Similarly mean onset time of motor block in group BD was 12.26 ± 3.96 min, and 11.58 ± 3.68 min in group B. By evaluating these times, we understood that the required time for initiating sensory and motor block in group BD was faster than groups B.

These results show a similar finding as in many previous studies using dexamethasone with bupivacaine for brachial plexus block.<sup>10-12</sup> This prolongation of analgesia may be explained by corticosteroid's local action on nociceptive C-fibers and upregulation of the function of potassium channels in excitable cells. However, most of these studies have demonstrated variation in the duration of analgesia.<sup>12-14</sup> Choi S et al.collected data from nine trials which include 801 patients with patients receiving either local anesthetic alone or in combination with perineural dexamethasone (4-10mg).<sup>10</sup> They conclude that dexamethasone significantly prolonged the analgesic duration of bupivacaine from 730 min to 1306 min (mean difference 576 minutes). In our study, the duration of

analgesia was increased by 3 fold in the dexamethasone group. The difference in study methodology may have accounted for this variation in the duration of analgesia among various studies like the use of the larger volume of injectate, variation in dexamethasone dose and use of adjuncts such as epinephrine or bicarbonate. Also, the mean onset of sensory block was significantly earlier in Group dexamethasone as shown in our study result. This could be due to the synergistic action of local anesthetics and dexamethasone.

Although many studies reported the prolonged duration of sensory and motor block when dexamethasone was used as an adjuvant with bupivacaine in brachial plexus block, they show variable results regarding the onset of sensory and motor block.<sup>15</sup> In his study, Vieira et al performed a brachial plexus block in 88 patients scheduled for shoulder arthroscopy using 20 ml of the local anesthetic mixture with dexamethasone adjuvant. There was no significant reduction in the onset of sensory and motor blockade in the dexamethasone group compared to the control group.<sup>11</sup> This discrepancy could be due to the difference in the local anesthetic volume and technique of block. The hemodynamic parameters such as heart rate, systolic BP, and diastolic BP were stable in both groups in our study. The limitation of our study was small sample size and short duration of study period. Further study will be conducted in large scale and cohort manner for precise and more accurate findings.

## Conclusion

Dexamethasone adjuncts to local anaesthetics effectively and significantly prolongs the duration of analgesia as well as producing earlier onset of action.

## Acknowledgement

We are grateful to all patient of Orthopaedics department who had participated in this study. We would like to give thanks department of Orthopaedics, Khwaja Yunus Ali Medical College and Hospital, Sirajganj, Bangladesh.

## References

- Neal J, Gerancher C, Hebl .Upper Extremity Regional Anesthesia: Essentials of Our Current Understanding, 2008. RegAnesth Pain Med. 2009 ; 34(2): 134-170.
- Yang C, Kwon H, Cho C. A comparison of infraclavicular and supraclavicular approaches to the brachial plexus using neurostimulation. Korean J Anesthesiol 2010 ; 58(3): 260-266.
- Buttner J. Axillary and Mid humeral approach for Brachial Plexus Block. Curr Opin Anaesthesiol 1998; 11: 499-502.
- Islam SM, Hossain MH, Maruf AA. Effect of Addition of Dexamethasone to Local Anaesthetics in Supraclavicular Brachial Plexus Block. JAFMC Bangladesh 2011; 7, (1), No 1: 11-15.
- Wakhlo R, Gupta V, Raina A, Gupta SD, Lahori VU. Supraclavicular Plexus Block: Effect of Adding Tramadol or Butorphanol as an Adjuncts to Local Anaesthetic on Motor and Sensory Block and Duration of Post-operative Analgesia. J Anaesth Clin Pharmacol 2009; 25(1): 17-20.
- Baral P, Pathak L. A study of Dexamethasone as an adjuvant with Bupivacaine for Supraclavicular Brachial Plexus Block. IOSR Journal of Dental and Medical Sciences 2019; 18 : 15-18.
- Raj SA, Singh DR, Charles SAJ, Krishnaveni N. Efficacy of Tramadol or Dexamethasone as an Adjuvant to Levobupivacaine in Ultrasound-guided Supraclavicular Plexus Block for Upper Limb Surgery: A Randomized Double-blinded Controlled Study. Anesth Essays Res. 2017;11(3):567-571.
- Cummings KC, Napierkowski DE, Parra-Sanchez I, Kurz A, Dalton JE, Brems JJ, et al. Effect of dexamethasone on the duration of interscalene nerve blocks with ropivacaine or bupivacaine. Br J Anaesth. 2011;107:446-453.
- Bindal D, Narang N, Mahindra R, Gupta H, Kubre J, Saxena A. Effect of Dexamethasone on Characteristics of Supraclavicular Nerve Block with Bupivacaine and Ropivacaine: A Prospective, Double-blind, Randomized Control Trial. Anesth Essays Res. 2018;12(1):234-239.
- Choi S, Rodseth R, McCartney C. Effects of dexamethasone as a local anaesthetic adjuvant for brachial plexus block: a systematic review and meta-analysis of randomized trials. British journal of anaesthesia. 2014; 112(3): 427-439.
- Vieira PA, Pulai I, Tsao GC, Manikantan P, Keller B, Connelly NR. Dexamethasone with bupivacaine increases duration of analgesia in ultrasound-guided interscalene brachial plexus blockade. European Journal of Anaesthesiology. 2010; 27(3):285-288.
- Islam S, Hossain M, Maruf A. Effect of addition of dexamethasone to local anaesthetics in supraclavicular brachial plexus block. Journal of Armed Forces Medical College, Bangladesh. 2011;7(1):11-14.
- Abdallah FW, Johnson J, Chan V, Murgatroyd H, Ghafari M, Ami N, et al. Intravenous Dexamethasone and Perineural Dexamethasone Similarly Prolong the Duration of Analgesia After Supraclavicular Brachial Plexus Block: A Randomized, Triple-arm, Double-Blind, placebo-Controlled Trial. Regional Anesthesia & Pain Medicine. 2015;40(2):125-132.
- Knezevic NN, Anantamongkol U, Candido KD. Perineural dexamethasone added to local anesthesia for brachial plexus block improves pain but delays block onset and motor blockade recovery. 2015.
- Albrecht E, Kern C, Kirkham K. A systematic review and meta analysis of perineural dexamethasone for peripheral nerve blocks. Anaesthesia. 2015;70(1):71-83