Original Research Article

Comparison of analgesic properties of perineural and systemic dexamethasone in patients undergoing upper limb surgeries under supraclavicular block

Sathyan Natarajan[1*], Karthikeyan G[2], Murugan T[3]

[1]Senior Assistant Professor, Department of Anesthesiology, Government Royapettah Hospital Kilpauk Medical College, Chennai, Tamil Nadu, India
[2]Assistant Professor, Department of Anesthesiology, Government Chengalpattu Medical College, Chengalpattu, India
[3]Professor and HOD, Department of Anesthesiology, Government Kilpauk Medical College, Chennai, Tamil Nadu, India
[*]Corresponding author email: **drsathyan76@gmail.com**

International Archives of Integrated Medicine, Vol. 4, Issue 11, November, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 26-10-2017 **Accepted on:** 06-11-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Sathyan Natarajan, Karthikeyan G, Murugan T. Comparison of analgesic properties of perineural and systemic dexamethasone in patients undergoing upper limb surgeries under supraclavicular block. IAIM, 2017; 4(11): 220-228.

Abstract

Introduction: Pain in the postoperative period is the distressing period after any surgeries particularly in the first 24 hours. Postoperative pain is associated with an increase in sympathetic activity leading to increases in heart rate, blood pressure, respiratory rate and even delirium and myocardial insults. Opioids and NSAIDS are very commonly used in the postoperative period in spite of their known adverse effects. So there is a need for a study to find a drug which prolongs the duration of analgesia in the postoperative period without many side effects so that usage of opioids and NSAIDS drugs in the first 24 hours can be decreased.

The aim of the study: To compare during supraclavicular brachial plexus block, the single perioperative dose of intravenous Dexamethasone and perineural Dexamethasone effects on onset and duration of sensory and motor blockade ; quality of analgesia and reduction in the dose of opioids in first 24 hour.

Materials and methods: A Randomized, Triple-Arm, Double-Blind, Placebo-Controlled Trial. Totally 90 patients were recruited in the study patients undergoing upper limb surgeries under supraclavicular block at govt. Kilpauk medical college hospital and govt. Royapettah Hospital from

December 2015 to May 2016 were included in the study. After obtaining written informed consent patients were divided into three groups of 30 in each group. Group A local anesthetics and perineural dexamethasone Group B local anesthetics & intravenous dexamethasone, Group C local anesthetics only.

Results: The Sensory and Motor block onset time between the intervention groups group A VS group B and group A VS group C were found to be statistically significant ($p < 0.05$) and the association between group B VS group c was found to be not statistically significant ($p>0.05$) as per unpaired t-test. The sensory & motor block duration time showed statistical significance in group A VS group C, group B VS group C ($p < 0.05$) but group A VS group B had no statistical significance($p > 0.05$) as per unpaired t-test. The association of Visual Analog Scale between the intervention groups (group A Vs group C and group B VS group C) and VAS scores at 6, 12 and 24 hours postoperatively were found to be statistically significant since $p < 0.05$ as per unpaired t-test. The number of doses of opioid required in 24 hours was considered to be statistically significant since $p < 0.05$ as per unpaired t-test between the intervention groups (group A VS group C and group B VS group C).

Conclusion: Systemic Dexamethasone is equally effective as perineural Dexamethasone in providing the significant duration of sensory, motor blockade and quality of analgesia. We come to a conclusion that Dexamethasone consistently decreases the postoperative pain scores and decrease the early & number of doses of opioid consumption (48 hours).

Key words

Intravenous Dexamethasone, Perineural Dexamethasone, Visual Analog Scale, Sensory Block, Motor Block.

Introduction

Dexamethasone as an adjuvant to local anesthetic drugs had been studied extensively with varying results. A Recent study on a single dose of systemic Dexamethasone 8 mg given intravenously in the preoperative period implies prolongation of analgesia after laparoscopic surgeries done under general anesthesia without any delay in wound healing and infections [1]. But previous few studies do not favor the use of intravenous Dexamethasone in the perioperative period for prolongation of postoperative analgesia [2]. There is a mixed result in terms of systemic Dexamethasone when it is used for pain relief. Dexamethasone is being used for a long time for chronic pain management but the mechanism of action, when administered through systemic route, is still under research [3]. The primary objective of this study is to compare the extent of analgesia when Dexamethasone is added to the nerve block solution and when it was given intravenously. The secondary objectives of this study were to look at the duration of motor blockade, opioid consumption, and complications of steroid use.

Materials and methods

Totally 90 Patients who underwent upper limb surgeries under supraclavicular block at Govt. Kilpauk Medical College Hospital and Govt. Royapettah Hospital from December 2015 to May 2016 were included in the study after obtaining written informed consent. The patient was assessed by applying inclusion and exclusion criteria.

Inclusion criteria

- Age 18-60 years.
- American Society of Anaesthesiologists (ASA) physical status I and II.
- Weight 45-70 kg.
- Only elective surgeries.5.Upper limb surgery.

Exclusion criteria

- Hypersensitivity to the local anesthetic drugs.
- Severe SHT
- Uncontrolled DM.
- Hepatic and renal diseases.
- Sepsis and osteoporosis.
- Anatomical deformities at the nerve block site.
- Local infection at the site of block. 8. Coagulopathy.
- Pneumothorax.
- Pregnancy.
- H/O peptic ulcer.

A total of 90 patients in the above-mentioned inclusion criteria were selected. Patients were divided into three groups of 30 in each group. Patients selected were counselled about the risks and benefits involved in performing the block. After getting consent, patients who were willing to be included in the study were enrolled and analyzed. This study was designed as a prospective, comparative study. Patients were preoperatively evaluated, clinically examined and proper investigations done prior to the assessment. Procedures were explained in detail and written consent was obtained. The procedure was carried out in the preparation room or in the theatre where facilities for resuscitation available. Routine monitoring included ECG, Pulse Oximetry, NIBP. Intravenous cannulation was done with 18G venflon. All supraclavicular blocks were given by using nerve locator. 1)A group of 30 patients who received supraclavicular brachial plexus block by 15 cc of 2% Lignocaine with adrenaline and 15 cc of 0.5% Bupivacaine along with 8 mg of Dexamethasone added in solution form group A. 2) A group of 30 patients who received supraclavicular brachial plexus block by 15 cc of 2% Lignocaine with adrenaline and 15 cc of 0.5% Bupivacaine and systemic Dexamethasone 8mg by intravenous route one hour before surgery form Group B. 3)A group of 30 patients who received supraclavicular brachial plexus block by 15 cc of 2% Lignocaine with adrenaline and 15 cc of 0.5% Bupivacaine along with 2cc of normal saline added in solution form Group C (control group). The patients were monitored throughout the surgery and postoperatively by continuous pulse oximetry, ECG, heart rate and non-invasive blood pressure for hemodynamics and the duration of blockade were assessed postoperatively. Sensory block was assessed in the C5-T2 dermatome and pain is assessed by pinprick method. Motor block was assessed by 1.At shoulder- By asking the patient to elevate the arm by keeping the elbow straight (to assess the superior trunk). 2. At hand-By the grip strength (to assess middle and lower trunk). Grade 0 no weakness, grade 2 pares is, grade 3 paralysis.In addition, the patient was constantly monitored in the intraoperative and postoperative period for changes in heart rate, blood pressure, and oxygen saturation. The onset of pain and the quality of analgesia was assessed in the postoperative period by Visual analog scale rating from 0 to 10. 0 indicates no pain, 10 indicates worst intolerable pain. The time of need of first rescue analgesia was also noted and Tramadol 100 mg IV was used as the rescue analgesia. The number of opioid usage in the first 24 hours was tabulated.

Data analysis

Descriptive statistics were done for all data and were reported in terms of mean values and percentages. Suitable statistical tests of comparison were done. Continuous variables were analyzed with the unpaired t-test. Categorical variables were analyzed with the Chi-Square Test and Fisher Exact Test. Statistical significance was taken as $P < 0.05$. The data were analyzed using SPSS version 16 and Microsoft Excel 2007.

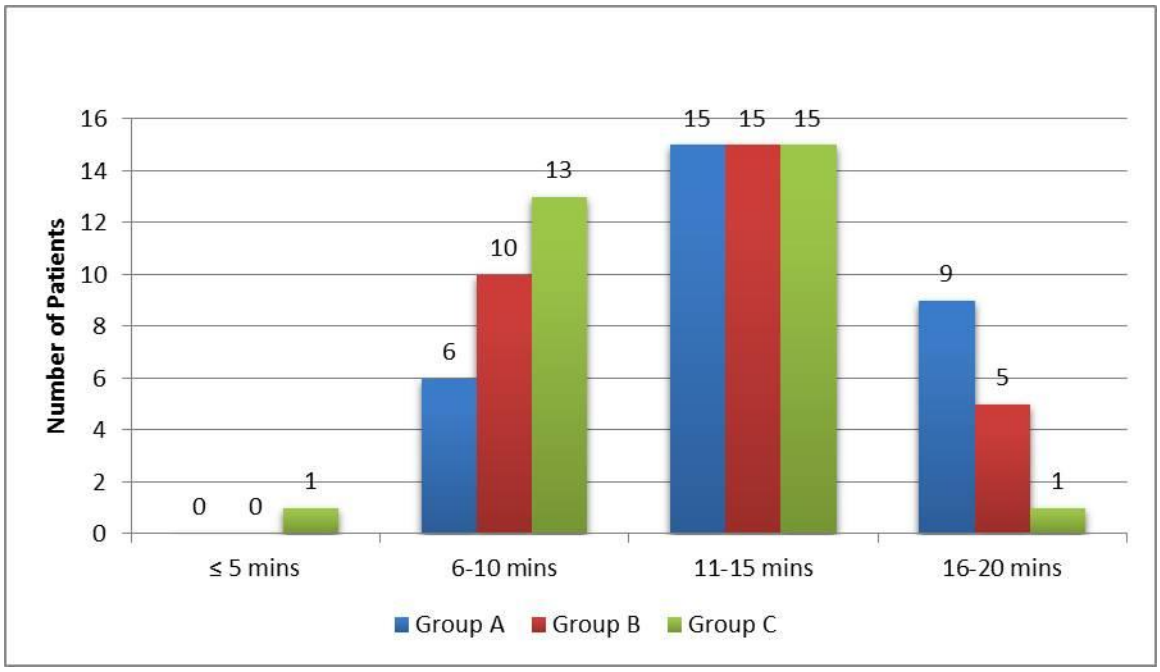
Results

The association between the intervention groups and age distribution, gender distribution, ASA PS status, weight height distribution, BMI, duration of surgery were found to be statistically not significant. Similarly the association between the intervention groups and Pulse rate, mean arterial pressure, Oxygen saturation among all

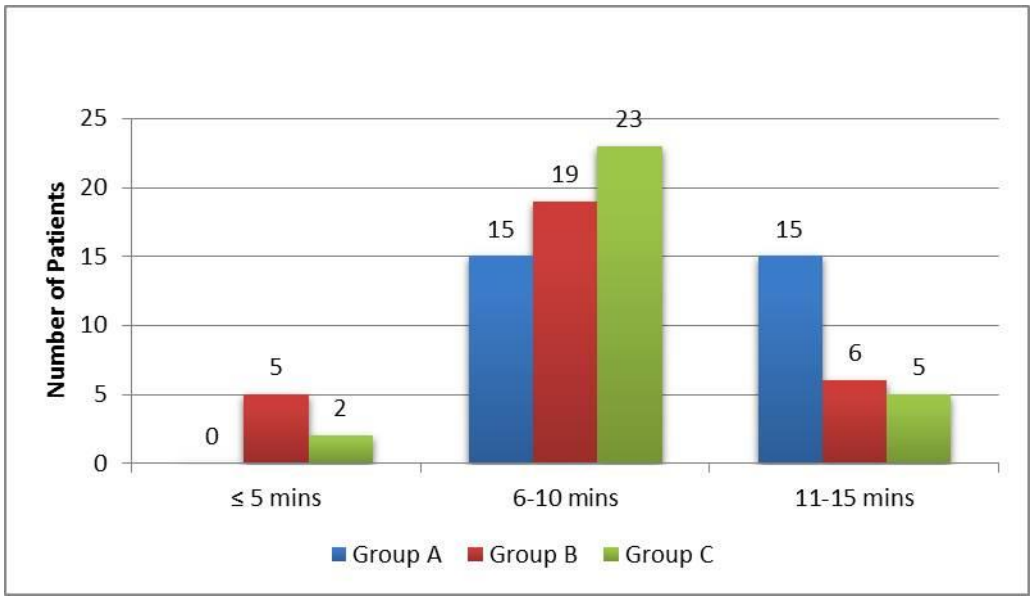
the common clinical parameters were found to be not statistically significant since $p > 0.05$ as per unpaired t-test. The incidence of gastritis, shivering, blood sugar values at 24 hours and nerve injury among the intervention groups were found to be not statistically significant with a $p > 0.05$ as per unpaired t - test.

By conventional criteria the association between the intervention groups (Group A Vs group B and Group A Vs Group C) and sensory block onset time is considered to be statistically significant since $p < 0.05$ as per unpaired t-test (**Graph – 1**).

Graph – 1: Onset sensory time –among the patients.

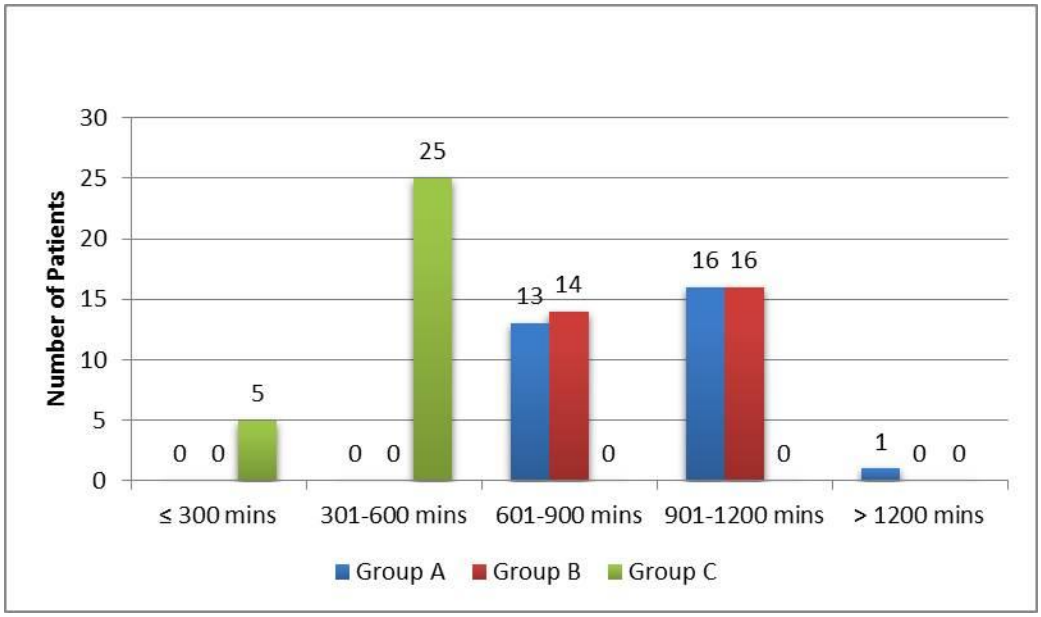


Graph – 2: Onset motor time – among the patients.

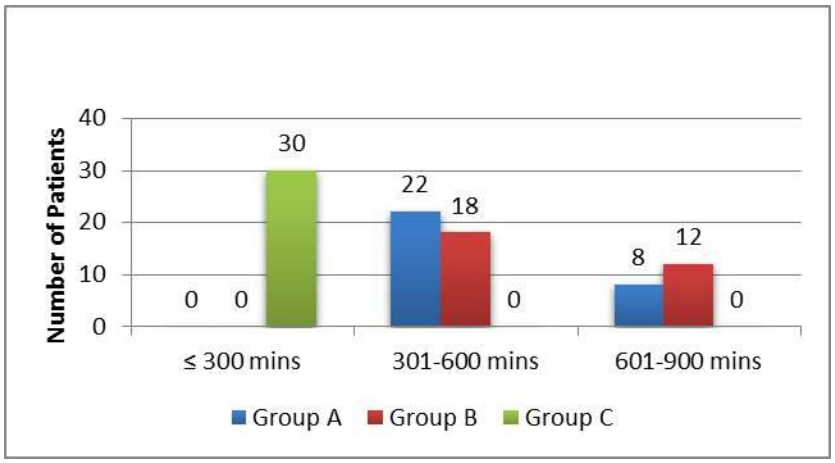


The association between the intervention groups (Group A Vs Group B and Group A Vs Group C) and motor block onset time is considered to be statistically significant since $p < 0.05$ as per unpaired t-test (**Graph – 2**).

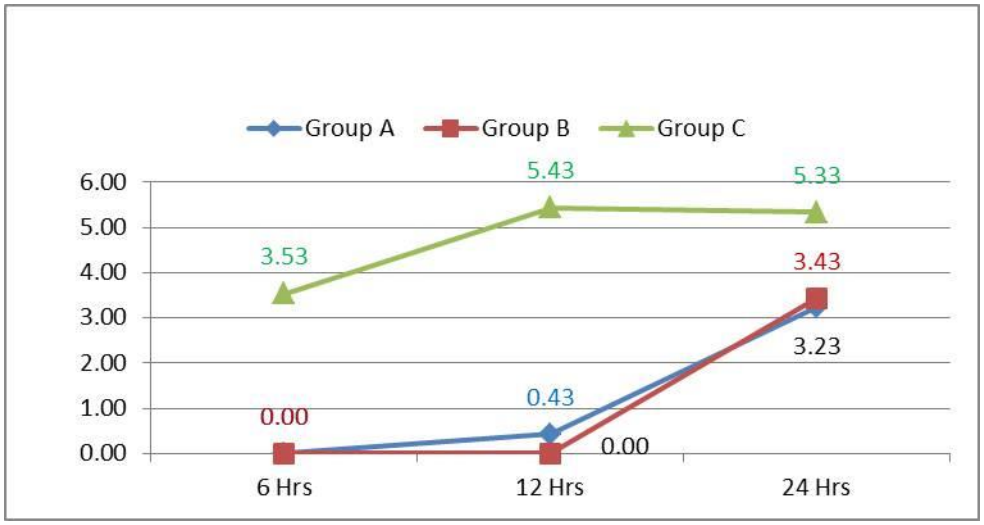
Graph - 3: Duration sensory blocking time –among the patients.



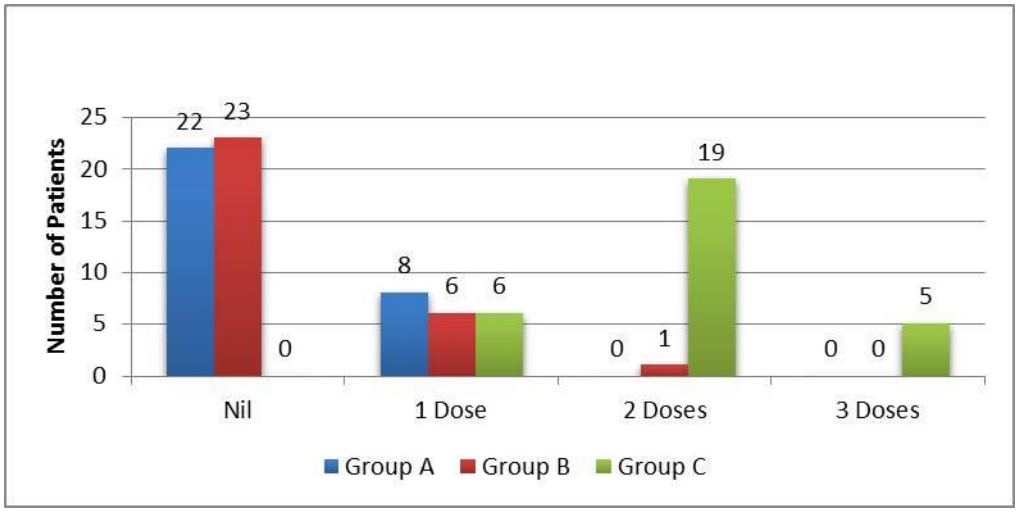
Graph – 4: Duration motor blocking time – among the patients.



Graph – 5: Visual analog score among patients.



Graph – 6: Number of opioid doses required in 24 hours.



Majority of the Group A patients belonged to 901-1200 minutes sensory block duration time class interval (n=16, 53.33%) with a mean sensory block duration time of 911 minutes. In the Group B patients, majority belonged to 901-1200 minutes sensory block duration time class interval (n=16, 53.33%) with a mean sensory block duration time of 897.50 minutes. In the Group C patients, majority belonged to 301-600 minutes sensory block duration time class interval (n=25, 83.33%) with a mean sensory block duration time of 340.33 minutes. The association between the intervention groups - groupA VS group C and group B VS group C, and sensory block duration time was found to be statistically significant since $p < 0.05$ as per unpaired t-test (**Graph – 3**).

Majority of the Group A patients belonged to 301-600 minutes motor block duration time class interval (n=23, 73.33%) with a mean motor block duration time of 538.50 minutes. In the Group B patients, majority belonged to 301-600 minutes motor block duration time class interval (n=18, 60%) with a mean motor block duration time of 592.50 minutes. In the Group C patients, majority belonged to ≤ 300 minutes motor block duration time class interval (n=30, 100%) with a mean motor block duration time of 242.33 minutes. By conventional criteria, the association between the intervention groups (group A VS group C and group B vs group C) found to be statistically significant since $p < 0.05$ as per unpaired t-test (**Graph – 4**).

VAS score at 6, 12 and 24 hours postoperatively between the intervention groups - group A VS group C and group B VS group C was found to be statistically significant since $p < 0.05$ as per unpaired t-test (**Graph – 5**).

Majority of the Group A patients required one dose of opioid in 24 hours (n=8, 26.67%). In the Group B patients, majority required one dose of opioid in 24 hours (n=6, 20%). %). In the Group C patients, majority required two doses of opioid in 24 hours (n=19, 63.33%). By conventional criteria, the association between the intervention groups (Group A Vs group C and Group B Vs Group C) and the number of doses of opioid required in 24 hours are considered to be statistically significant since $p < 0.05$ as per unpaired t-test (**Graph – 6**).

Discussion

Pain in the postoperative period is the distressing period for any patient which many drugs are being used with varying safety concerns. NSAIDS and Paracetamol are used in many patients but the intensity of analgesia vary from patients to patients which may not be complete pain relief for those with a minimum threshold [11]. Opioids might provide better analgesia but leads to many complications particularly when

large and cumulative doses are used which needs close hemodynamic and respiratory monitoring in the postoperative period [12]. Many studies are being done to find the efficacy of single intravenous dexamethasone in the preoperative period. This study was undertaken to find out whether intravenous dexamethasone has real impact on the duration of postoperative pain relief (primary outcome). In this study the mean sensory and motor block onset time was significantly faster in Intravenous Dexamethasone group compared to perineural group [a mean difference of 1.50 minutes (12% faster)sensory & a mean difference of 2.53 minutes (29% faster) motor] [13]. This difference is significant with a p-value of 0.0414, 0.0003 as per unpaired t-test. Similarly the mean sensory & motor block onset time was significantly faster in control group than perineural group. Very few studies were available to find the effect of Dexamethasone on the onset of sensory and motor blockade. Those studies conclude that Dexamethasone does not have much effect on the onset of sensory and motor blockade. On the contrary, our study shows that perineural Dexamethasone delays the onset of sensory and motor blockade with statistical difference. Further studies are in need to find their effects on the onset of the block [14]. In this study, the mean duration of sensory blockade in perineural dexamethasone is 911 minutes, in intravenous dexamethasone is 897.50 minutes, and in control group is 340.33 minutes. The mean sensory block duration time was significantly longer in perineural group compared to control group [mean difference of 570.67 minutes (2.67times)] and intravenous group compared to control group [mean difference of 557.17 minutes (2.64times) In our study, the mean motor block duration time was significantly longer in perineural group compared to control group [mean difference of 296. (2.22times)] and intravenous group significantly longer than control group [mean difference of 350.17minutes (2.44 times) Studies conducted by Faraj et al the mean duration of sensory blockade with perineural Dexamethasone and intravenous Dexamethasone is 1500 minutes(25 hours). The mean duration of analgesia with a control group is 792 minutes. There is no statistically significant difference between perineural Dexamethasone and Intravenous [15]. Dexamethasone group in the duration of analgesia in our study, Faraj et al study. In both studies, a statistically significant difference exists between perineural Dexamethasone with the control group as well as Intravenous Dexamethasone with control groups. The previous study was done by Desmet et al on perineural and systemic Dexamethasone on interscalene block along with Ropivacaine also showed both perineural and intravenous route are equivalent in increasing the duration of analgesia [5]. Fredrickson et al showed an even single intramuscular injection of 8mg of Dexamethasone in patients undergone sciatic or ankle block showed the similar duration of the sensory block as perineural Dexamethasone. But the major disadvantage of Fredrickson study was it lacked statistical power [16]. In the study done by Salviz EA et al, the mean duration of motor blockade with perineural Dexamethasone is 1500 minutes and that of Intravenous Dexamethasone is 1800 minutes. These prolongation of the motor blockade of the above two groups were very much significant when compared to control groups. But at the same time, the mean duration of motor blockade with Intravenous Dexamethasone is statistically significant when compared to the perineural group [17]. The mean VAS score in this study, was significantly less in Intravenous Dexamethasone group and perineural dexamethasone group compared to control group by a mean difference of 1.90 scoring points (36%) and 2.10 scoring points (39%). This difference is significant with a p-value of <0.0001 as per unpaired t-test. The quality of analgesia between perineural Dexamethasone and systemic Dexamethasone at 6 hours, 12 hours and 24 hours is not statistically significant. These parameters with relating to the quality of analgesia are very much comparable to the data provided by Sadowski M, et al. [16] study. The hemodynamic profile of the patients in perineural and systemic Dexamethasone group is also much better after 6 hours while compared to control group and this profile is also

comparable to Faraj et al study [5, 16]. The number of patients who needed at least one dose of opioid in 24 hours was significantly lower in Intravenous Dexamethasone group & perineural dexamethasone group compared to control group by a mean difference of 23.33 percentage points (77% lower) and 26.67% points (73% lower) respectively. This difference is significant with a p-value of <0.0001as per unpaired t-test. These parameters were very much similar to the Farah et al, Sehmbi H, et al study where cumulative opioid (morphine) requirements were less in perineural and systemic Dexamethasone group compared to control groups [18, 19, 20].

Conclusion

Systemic Dexamethasone has a similar duration of postoperative analgesia as perineural Dexamethasone. So single preoperative dose of Dexamethasone can be administered safely even for the patients who undergo General anesthesia as it is also effective in the prevention of postoperative nausea and vomiting and it significantly decreases the postoperative opioid requirements. Systemic Dexamethasone is equally effective as perineural Dexamethasone in providing the significant duration of sensory, motor blockade and quality of analgesia. The incidence of steroid-related complications like gastritis, delayed wound healing, are less except a mild increase in blood sugar with single perioperative intravenous Dexamethasone. Dexamethasone may not be effective in the prevention of intraoperative and postoperative shivering.

References

1. Abell DJ, Barrington MJ: Pneumothorax after ultrasound-guided supraclavicular block: presenting features, risk, and related training. Reg Anesth Pain Med., 2014; 39(2): 164–7.
2. Abdallah FW, Halpern SH, Aoyama K, et al. Will the Real Benefits of Single-Shot Interscalene Block Please Stand Up? A Systematic Review and Meta-Analysis. Anesth Analg., 2015; 120(5): 1114–29.
3. Chin KJ, Alakkad H, Adhikary SD, et al. Infraclavicular brachial plexus block for regional anesthesia of the lower arm. Cochrane Database Syst Rev., 2013; 8: CD005487.
4. Chin KJ, Alakkad H, Cubillos JE. Single, double or multiple-injection techniques for non-ultrasound guided axillary brachial plexus block in adults undergoing surgery of the lower arm. Cochrane Database Syst Rev., 2013; 8: CD003842.
5. Fredrickson MJ, Ball CM, Dalgleish AJ. Analgesic effectiveness of a continuous versus single-injection interscalene block for minor arthroscopic shoulder surgery. Reg Anesth Pain Med., 2010; 35(1): 28–33.
6. Gamo K, Kuriyama K, Higuchi H, et al. Ultrasound-guided supraclavicular brachial plexus block in upper limb surgery: outcomes and patient satisfaction. Bone Joint J., 2014; 96-B(6): 795–9.
7. Gelfand HJ, Ouanes JP, Lesley MR, et al. Analgesic efficacy of ultrasound-guided regional anesthesia: a meta-analysis. J Clin Anesth., 2011; 23(2): 90–6.
8. Guay J: [The neurostimulator for brachial plexus blockade by the axillary approach: a meta-analysis on its efficacy to increase the success rate]. Ann Fr Anesth Reanim., 2005; 24(3): 239–43.
9. Kumar A, Sharma D, Sibi ME, et al. Comparison of peripheral nerve stimulator versus ultrasonography-guided axillary block using multiple injection techniques. Indian J Anaesth, 2014; 58(6): 700–4.
10. Mariano ER, Afra R, Loland VJ, et al. Continuous interscalene brachial plexus block via an ultrasound-guided posterior approach: a randomized, triple-masked, placebo-controlled

study. Anesth Analg., 2009; 108(5): 1688–94.
11. Meierhofer JT, Anetseder M, Roewer N, et al. Guidance of axillary multiple injection technique for plexus anesthesia. Ultrasound versus nerve, 2014; 63(7): 568–73.
12. Neal JM, Brull R, Horn JL, et al. The Second American Society of Regional Anesthesia and Pain Medicine Evidence-Based Medicine Assessment of Ultrasound-Guided Regional Anesthesia: Executive summary. Reg Anesth Pain Med., 2016 Mar-Apr; 41(2): 181-94.
13. Neal JM. Ultrasound-Guided Regional Anesthesia and Patient Safety: Update of an Evidence-Based Analysis. Reg Anesth Pain Med., 2016; 41(2): 195–204.
14. Rennes SH, Rettig HC, Gielen MJ, et al. Ultrasound-guided low-dose interscalene brachial plexus block reduces the incidence of hemidiaphragmatic paresis. Reg Anesth Pain Med., 2009; 34(5): 498–502.
15. Rennes SH, Spoormans HH, Gielen MJ, et al. Hemidiaphragmatic paresis can be avoided in ultrasound-guided supraclavicular brachial plexus block. Reg Anesth Pain Med., 2009; 34(6): 595–9.
16. Sadowski M, Tułaza B, Lysenko L. Renaissance of supraclavicular brachial plexus block. Anaesthesiol Intensive Ther., 2014; 46(1): 37–41.
17. Salviz EA, Xu D, Frulla A, et al. Continuous interscalene block in patients having outpatient rotator cuff repair surgery: a prospective randomized trial. Anesth Analg., 2013; 117(6): 1485–92.
18. Sehmbi H, Madjdpour C, Shah UJ, et al. Ultrasound-guided distal peripheral nerve block of the upper limb: A technical review. J Anaesthesiol Clin Pharmacol., 2015; 31(3): 296–307.
19. Stundner O, Meissnitzer M, Brummett CM, et al. Comparison of tissue distribution, phrenic nerve involvement, and epidural spread in standard- vs low-volume ultrasound-guided interscalene plexus block using contrast magnetic resonance imaging: a randomized, controlled trial. Br J Anaesth., 2016; 116(3): 405–12.
20. Sunderland S, Yarnold CH, Head SJ, et al. Regional Versus General Anesthesia and the Incidence of Unplanned Health Care Resource Utilization for Postoperative Pain After Wrist Fracture Surgery: Results From a Retrospective Quality Improvement Project. Reg Anesth Pain Med., 2016; 41(1): 22–7.