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Intravenous Dexamethasone prolongs Analgesia Provided by Interscalene Block for Shoulder Arthroscopic Surgery

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Abstract

Background: Dexamethasone added to local anesthetics prolongs the analgesia duration in various local blocks. However, intravenous dexamethasone also produces a similar effect in prolongation of analgesia duration.

Context: Interscalene block in shoulder arthroscopic surgeries. **Aims**: The study aims to compare the analgesic efficacy of two different doses of intravenous dexamethasone along with 10 ml of 0.5% bupivacaine in ultrasound guided interscalene block. This study also evaluated overall recovery of patients using QoR-40 score.

Subject and Methods: In the study, 90 patients scheduled for shoulder arthroscopies were divided into 3 groups, group A, group B, group C (n=30 in each group). All the groups received ultrasound guided interscalene block with 10 ml of 0.5% bupivacaine after GA. Group A did not receive any intravenous dexamethasone (control group). Group B received 0.1mg/kg intravenous dexamethasone and group C received 0.05 mg/kg intravenous dexamethasone. Intraop vitals and post op VAS scores were compared at 30 minutes 1, 3,6,12 and 24 hours after surgery. QoR-40 score was assessed at 24 hours after surgery.

Results: First rescue analgesia given in the postoperative period was after 192±129 minutes (group A), 383±153 minutes (group B) & 357±209 minutes in group C. The VAS scores were lower in group B and C till 24 hours when compared to group A.

Conclusions: Both the doses of intravenous dexamethasone yielded equivalent results. The time of first rescue analgesia was significantly prolonged in group B & C. The incidence of nausea and vomiting was also less in dexamethasone groups and overall post op recovery as assessed by QoR-40 score was also better in dexamethasone groups.

Keywords: Interscalene block, shoulder arthroscopy, dexamethasone, bupivacaine, ultrasound guided

Introduction

Orthopedic surgeries are well known for intense pain. In particular shoulder surgeries are associated with severe post-operative pain that necessitates opioid use for several days but side effects of opioids (nausea and vomiting, pruritus, sleep disturbances and constipation etc.) limit their use. [1] A commonly used nerve block for shoulder surgery is interscalene brachial plexus block (ISB). Even single dose interscalene brachial plexus block provides significant analgesia. [2] Various adjuvants like epinephrine, clonidine, ketamine, [3, 4, 5] dexamethasone [6, 7] have been studied with variable results. Dexamethasone appears to be effective in a number of pre-clinical and clinical studies when used perineurally. It has also been seen that intravenous dexamethasone augments the analgesic effect of peripheral nerve blocks. Dexamethasone when given perineurally or intravenously prolongs analgesia after a single shot ISB regardless of route of administration.[8] Perineural dexamethasone however can be neurotoxic. Intravenous dexamethasone at a dose more than 0.1 mg/kg is an effective adjunct in multimodal strategies to reduce post-operative pain and opioid consumption after surgeries.[9] However, doses less than 0.1 mg/kg for intravenous dexamethasone along with peripheral nerve blocks has not been used or compared. This study is therefore designed to evaluate the analgesic efficacy of two doses of intravenous dexamethasone (0.1mg/kg versus 0.05mg/kg) when given along with interscalene block using bupivacaine in patients undergoing arthroscopic shoulder surgeries. We also evaluated the overall recovery of the patients post operatively using Quality of Recovery 40 score (QoR-40 score). It is a global score in the form of 40-item questionnaire covering five dimensions: patient support, comfort, emotions, physical independence, and pain. The score measures quality of recovery in early postoperative period.[10]

Materials and Methods

This study was conducted after approval from hospital ethical committee. This prospective and interventional randomized comparative study was conducted on 90 patients randomly allocated into 3 groups with 30 patients in each group according to block randomization technique. All groups received interscalene block using 10 ml of 0.5% bupivacaine. Group B and C were given 0.1 mg/kg and 0.05mg/kg of intravenous dexamethasone respectively in addition to interscalene block, whereas group A did not receive any intravenous.

All adult patients (18-60 years of age) of ASA grades I and II scheduled for elective shoulder surgery were included in the study, whereas the patients with history of allergy to local anesthetic, coagulopathy, diabetes mellitus, and steroid use in past 1 year were excluded from the study.

Methodology

Preoperative period

All patients underwent a detailed pre-anesthetic checkup and were kept fasting overnight. They were advised to take Tab. Alprazolam 0.25 mg in the night and again at two hours prior to surgery. After intravenous line was secured, i.v. Metoclopramide 10 mg and i.v. Ranitidine 50 mg were given to the patient 45 minutes before surgery.

Anesthetic technique

In the operation theatre the baseline parameters were recorded i.e. SpO_2 , ECG, heart rate, BP (systolic, diastolic, mean,) respiratory rate, pre-operative fasting blood sugar. Patients were explained about the interscalene block.

Interscalene block (ISB) procedure: Under all aseptic precautions ultrasound guided interscalene block was performed on the ipsilateral side. Group A had received 10 ml, 0.5% bupivacaine, group B had received 10 ml 0.5% bupivacaine with 0.1mg/kg intravenous dexamethasone and group C had received 10 ml, 0.5% bupivacaine with 0.05mg/kg intravenous dexamethasone. After the block, PR, BP, RR and SpO2

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and sensory and motor block assessment was recorded at every 10 minutes till 20 minutes

Block assessment: Blockade was evaluated by observer who was blinded to the dose of drug injected. Motor blockade was determined by loss of shoulder abduction and sensory blockade was taken as loss of sensation to alcohol sponge in the C4-7 dermatome. Immediate complications, such as hematoma formation, Horner's syndrome, hoarseness, respiratory distress, and spinal /epidural injection were assessed during this period as well as post-operatively.

Intra-operative management After 30 min, general anesthesia was given to the patients of all the groups. Anesthesia was induced with i.v. fentanyl (2mcg/kg), i.v. propofol (2 - 2.5 mg/kg) and neuromuscular blockade was achieved with i.v. vecuronium (0.1 mg/kg) to facilitate intubation. All patients were mechanically ventilated and anesthesia was maintained by O2, N2O, Isoflurane (0.5-1%). If mean arterial BP or heart rate had increased to >20% above baseline value, then inj. fentanyl 0.5 mcg/kg was administered and noted. At the end of operation residual neuromuscular blockade was reversed by inj. Neostigmine 0.05 mg/kg and inj. Glycopyrrolate 0.01 mg/kg. Post-operative nausea and vomiting was managed by inj.Ondansetron 0.1 mg/kg.

Post-operative period

Postoperative pain was evaluated at 30 minutes, 1, 3, 6, 12 and at 24 hours from the completion of surgery using a Visual Analogue Scale (VAS) scoring from zero (no pain) to 10 (worst pain). Rescue analgesia in the form of inj. Paracetamol 1 g i.v. was administered on demand or if VAS score is > 4 and its time was noted. If pain was not relieved, then inj. Diclofenac was given. Preoperative and postoperative chest X-rays in upright posture were compared; hemi diaphragmatic palsy was defined as the elevation of the diaphragm >4 cm above its preoperative position. Also, at 24 hours after completion of surgery the patients were evaluated for quality of overall recovery using the QoR-40 Score. This score ranges from 40 (extremely poor quality of recovery) to 200 (excellent quality of recovery). Patients were telephonically acquired for any postoperative wound infection and paresis at the end of one week in the operated limb.

Statistical analysis

Quantitative variables were compared using Un-paired t-test/Mann-Whitney Test (when the data sets were not normally distributed.) between the two groups and Anova / Kruskal Wallis test (for non-parametric data) was used to compare three groups. Qualitative variable was compared using Chi-Square test /Fisher's exact test. A p value of < 0.05 was considered statistically significant. The data was entered in MS EXCEL spread sheet and analysis was done using Statistical Package for Social Sciences (SPSS) latest version.

Observations and results

In this prospective, randomized, double blind study, 90 patients underwent elective arthroscopic shoulder surgery. Patients were randomly divided into Group A (n=30), Group B (n= 30) and Group C (n= 30). Demographic data was similar in all the groups, as shown in table 1. We observed that all the groups had statistically significant decrease in heart rate and blood pressure from baseline intra-operatively which was maintained till the end of surgery (Figure 1 and 2). This could be attributed to the fact that successful block was given to all the patients in all the three groups. As shown in table 2, the number of patients with VAS scores <4 were much higher in group B and C (p value < 0.05). It can be inferred that most of the patients of group B and C were painless till 12 and 24 hours with

lesser VAS scores. At 6 hours (360 minutes), VAS scores of group B and C are comparable to group A. This can be explained by the fact that first dose of rescue analgesia was given at the same time. However, VAS scores were comparable between group B and C and were statistically insignificant. The mean duration of 1st rescue analgesia given in the postoperative period was 192±129 minutes in group A, 383±153 in group B and 357±209 in group C comparison of which was statistically highly significant (p value 0.0001).(Table 3). Overall rescue analgesia required over 24 hours was much less in group B and C. Number of patients requiring analgesia thrice or more was much higher in group A i.e. 56 % whereas in group B and C, it was only 3.3% and 10% respectively. (Table 3) Comparison of P value among group A and B was highly significant (0.0001) as well as among group A vs C (0.007). The mean QoR-40 score in the postoperative period was best in group B (189) followed by group C (186) and least in group A (176). The p value as calculated by anova test is 0.0001 is highly significant when compared to group A. Therefore group B and C offered better overall patient satisfaction due to added analgesic and anti-emetic effect of intravenous dexamethasone. The mean increase in random blood sugars was 43.3 mg/dl in group B, 23.6 mg/dl in group C and 3 mg/dl in group A. This means the percentage rise in blood sugar was maximum in group B when compared with group C. Though the mean increase in sugar values is statistically significant in group B and group C but this increase is not clinically significant (Table 4). Furthermore, group receiving lower dose of dexamethasone had lesser increase in blood sugar values. The incidence of nausea and vomiting was much higher in control group (36.7%) as compared to

group B (10%) and C (13.3%) (Figure4). None of the patients had post-operative infection or paresis when enquired telephonically.

Table 1: Demographic profile

	Group A	Group B	Group C
Mean age in years	33.86	34.03	31.37
Sex (M/F)	24/6	19/11	29/1
ASA(I/II)	27/3	19/11	29/1
Mean duration of	65.4	70.6	63.2
surgery in minutes			

Table 2: Frequency distribution of VAS scores <4

Time post	Group		p value			
surgery (minutes)	А	В	C	A vs B	A vs C	B vs C
30	26	28	28	0.389	0.389	1.000
60	17	24	24	0.002	0.002	0.488
180	8	27	27	0.001	0.001	1.000
360	17	14	16	0.43	0.795	0.605
720	13	27	23	0.0001	0.008	0.160
1440	15	27	23	0.0007	0.032	0.165

Table 3: Rescue analgesia and QoR-40 score

Parameter	Group A	Group B	Group C
Time to first rescue analgesia(minutes)	192±129	383±153	357±209
Number of patients	17	1	3
requiring analgesia	(56.6%)	(3.3%)	(10%)
thrice or more			
QoR-40 score	176/200	189/200	186/200

Table 4: Blood sugars among three groups

Blood sugar	Group A	Group B	Group C
Pre-op	92.6	84.5	91.43
Post-op	95.6	127.8	115
Mean increase	3	43.3	23.6
% increase in blood	3.2%	51.24%	25.81%
sugar			
P value within group	0.0556	0.0001	0.0001

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Figure 1: Intraoperative Heart rate (beats per minute)

Figure 2:Intraoperative mean blood pressure(mmHg)



Figure 3: Incidence of post-operative nausea and vomiting



Discussion

Acute post-operative pain can be very distressing in evaluating the outcome of a surgical procedure. Various modalities of regional anesthesia help us alleviate this phenomenon. In shoulder surgery, commonly used blocks are single shot ISB with or without adjuvants, supra-scapular with or without axillary (circumflex) nerve block, supraclavicular nerve block and

continuous ISB infusions. [11]. Dexamethasone is an effective adjuvant in prolonging the duration of analgesia in various blocks. [6, 7, 13, 14, 15] Dexamethasone is a highly selective glucocorticoid and may prolong block duration by increasing the activity of inhibitory potassium channels on nociceptive C fibers or by causing vasoconstriction via glucocorticoid receptor mediated nuclear transcription modulation. [7] Dexamethasone's suppression of inflammatory mediators, like prostaglandins (PGE2), may also play a role. Indirect evidence has supported the assumption that dexamethasone acts locally, however recent studies have suggested a systemic effect may be responsible for its clinical effect and intravenous administration may give similar results. [12] Regardless of its specific mechanism, the best evidence suggests its action is via indirect mechanisms rather than by directly inhibiting neurotransmission. Intravenous dexamethasone at a dose more than 0.1 mg/kg is an effective adjunct in multimodal strategies to reduce post-operative pain and opioid consumption after surgeries. [9]

Various studies have been published showing that intravenous dexamethasone is as good as perineural dexamethasone in prolonging the analgesic duration of a single-shot ISB with local anesthetics in brachial plexus block. [8, 16, 17, 18] So, it is suggested that both perineural and intravenous dexamethasone are useful adjuncts as well as intravenous route is preferred as it avoids possibility of neurotoxicity. [16] A similar result was shown by Abdallah et al in 2015 and duration of analgesia was prolonged up to 25 hours by 8 mg dexamethasone irrespective of the route. [9]

The major adverse events related with the use of intravenous dexamethasone intra-operatively are postoperative infection, hyperglycemic events, delayed healing, and pruritus. [9]

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With this background, we decided to evaluate the analgesic efficacy of 0.05 mg/kg of intravenous dexamethasone compared with higher dose. We chose the technique of ultrasound guidance for interscalene block with 10 ml of 0.5 % bupivacaine in all the groups. Group A was not given any intravenous dexamethasone, group B was given 0.1mg/kg of intravenous dexamethasone along with the block while group was given 0.05 mg/kg of intravenous dexamethasone with the block. We also evaluated the quality of recovery in all patients post-operatively using QoR-40 score.

Though there are limited number of studies using QoR-40 score after peripheral nerve blocks, Gornall et al in their systematic review had concluded that the QoR-40 is a widely used and extensively validated measure of quality of recovery and is a suitable measure of postoperative quality of recovery in a range of clinical and research situations. [19] This score has also been used by various authors to evaluate the post-operative recovery after regional blocks. [20]

All the groups were comparable in terms of demographic variables and intraoperative vitals. All parameters were stable throughout and no rescue analgesia was required intra-operatively. The lower dose of dexamethasone yielded equivalent results as that of higher dose. Overall pain scores were significantly reduced in both group B and C as compared to group A. The requirement of first rescue analgesia was significantly prolonged in group B and C as compared to group A. Overall analgesia required was also much less in our study groups. There were no major complications in our study. Though there was rise in blood sugars intra operatively in the study groups, it was not clinically significant. The incidence of nausea and vomiting was also less in dexamethasone

groups. The overall postoperative recovery of the patients as assessed by QoR-40 score was better in both the study groups.

Conclusion

We conclude that intravenous dexamethasone is an effective adjunct in prolonging the duration of analgesia after interscalene block. Both the doses are beneficial and even the lower dose dexamethasone produces comparable and similar effects as higher dose of intravenous dexamethasone, at the same time with lesser rise in blood sugars. It not only prolonged the duration of block, the total requirement of analgesia was reduced and overall recovery of patients was also better in terms of physical comfort and patient satisfaction.

Abbreviations

ISB- Interscalene block, QoR-40 – Quality of Recovery 40 Score, VAS – Visual Analogue Scale

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